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ARMED FORCES CHEMICAL ASSOCIATION

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The members of this Association, mindful of the vital importance to national defense of chemistry, allied sciences, and the arts derived from them, have joined together as a patriotic obligation to preserve the knowledge of, and interest in, national defense problems derived from wartime experience; to extend the knowledge of, and interest in, these problems; and to promote cooperative endeavor among its members, the Armed Services, and civilian organizations in applying science to the problems confronting the military services and other defense agencies, particularly, but not exclusively in fields related to chemical warfare. (From Art. II, AFCA Constitution.)

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POLICY

The fact that an article appears in this magazine does not indicate approval of the views expressed in it by any one other than the author. It is our policy to print articles on subjects of interest in order to stimulate thought and promote discussion; this regardless of the fact that some or all of the opinions advanced may be at variance with those held by the Armed Forces Chemical Association, National Officers, and the Editors. It is the responsibility of contributors, including advertisers, to obtain security clearance, as appropriate, of matter submitted for publication. Such clearance does not necessarily indicate indorsement of the material for factual accuracy or opinion by the clearing agency.

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INDEX

	Page
Air Pollution Conference—Chemical Industry Activity	23
A.F.C.A. Affairs—1959 Meeting Announcement	2
Association of the U.S. Army Meeting Accents Missiles	32
Chemical Corps News	34
1st Chemical Regiment Memorial Trees—Ltr. *from* COL. H. C. ROBERTS	33
Defense Chemistry ..... *By* DR. WILLIAM T. READ, SR.	20
Deterioration of Materials and Equipment ..... *By* C. J. WESSEL	14
Drafted Chemical Engineer, The— ..... *Address by* BRIG. GEN. J. H. ROTHSCHILD, USA-RET.	28
OCDM Plan for Improvised Fallout Shelter	31
Psycho-Chemical Warfare—Editorial	4
Seapower ..... *Address by* ADMIRAL ARLEIGH A. BURKE	24
General Stubbs' New York Speech	8
West With an Army Chemist-Explorer..... *By* WYNDHAM MILES, PH.D	18

ADVERTISERS

	Page		Page
Columbia-Southern Chemical Corp.	iv	Kuhn, H.A., Consultant	33
Delta Chemical Works, Inc.	29	Mine Safety Appliances Company	9
General Tire & Rubber Co., Industrial Products Division	15	Reynolds Metals Company	3
Harshaw Chemical Corporation, The	13	Shell Chemical Corporation	11
Hooker Chemical Corporation	23	Union Carbide Chemicals Company	17

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A. F. C. A. AFFAIRS

1959 A. F. C. A. MEETING WASHINGTON, SEPT. 10-11

The next annual meeting of the general membership of the Armed Forces Chemical Association will be held at the Hotel Statler, Washington, D.C., September 10 and 11, 1959. This will be the 14th annual meeting since the organization of the Association in 1946.

This announcement was recently made by Mr. Donald MacArthur, Vice President of the Association and Chairman of the Meetings Committee. Mr. MacArthur is the Washington representative of Koppers Company, Inc., 1701 K Street, N. W. Assisting him on his general committee on arrangements are Rear Admiral M. P. Hottel, USN (Ret.), Manager National Lead Company, 1025 Connecticut Avenue, Washington, D.C.; Mr. L. Douglas Weiford, Washington representative of the Stauffer Chemical Co., Suite 41, 1500 Massachusetts Avenue, N. W., who is also president of the Washington chapter of A.F.C.A.; and Mr. Carroll W. Hayes, Washington Manager, Celanese Corporation of America, Suite 403, 1026 17th St., N.W.

The Board of Directors at their annual meeting in Atlantic City last June decided that the next three general meetings of the Association would be held in the Nation's Capital and called upon the Executive Committee to explore the possibilities for holding the meetings in the fall rather than in the late spring or early summer, as has been the practice heretofore. It was pursuant to that that the fall meeting was decided upon.

The "host service" for the coming meeting will be the Navy, and it is planned that the program will, therefore, generally emphasize naval concerns in National Defense in which the Association is especially interested. Commander H. S. Hansen, USN, is the naval officer on duty in Washington designated as liaison officer for A.F.C.A. activities, and the officer who acts in a similar capacity for the Marine Corps is Major R. J. McNicholas, USMC.

Tentative plans for the specific program are under consideration and it is expected that further announcements with respect to the annual meeting will be made at an early date.

GEN. SAYRE ACTIVE IN CLEVELAND AND NEW YORK SCIENCE MEETINGS

Brig. General Clifford L. Sayre, USAR, Director of Central Engineering for the Chemical Divisions, Food Machinery & Chemical Corporation; and president of A.F.C.A., was the guest speaker at the tenth annual dinner of the Chemical Profession of Cleveland, held at the new building of the Cleveland Engineering Society on the evening of Veterans Day, November 11, 1958.

General Sayre was introduced by Mr. Wells N. Thompson, president of the H. K. Ferguson Company.

In his speech entitled "Alternate Answers Also Pay Off," General Sayre, drawing upon his extensive engineering experience in industry and the Chemical Corps of the Army, told of interesting and often unusual results of the application of alternate solutions to research and development problems.

General Sayre currently holds the Army mobilization assignment of Deputy Chief Chemical Officer for Research and Development.

Some three hundred attended the meeting which was sponsored by the Cleveland sections of five national societies devoted to chemistry.

Later in the same month, General Sayre participated in the Sixth Annual Science and Engineering Conference in New York City sponsored by the Technical Societies of New York with the cooperation of the city's public and parochial schools. The program consisted of simultaneous sessions, held at New York University and Hunter College on November 22, for counselling senior high school and prep school pupils seeking guidance for college careers in science or engineering. General Sayre was counselor on Chemical Engineering at the sessions held at Hunter College.

The conference was sponsored by national science and engineering societies with the support, as patrons, of industrial firms, a considerable number of which are corporate members of A.F.C.A.

PINE BLUFF CHAPTER AND ACS GROUP HOLD JOINT MEETING

The Pine Bluff (Arkansas) Arsenal Chapter of A.F.C.A. joined forces with the Central Arkansas section of the American Chemical Society for a recent meeting at Pine Bluff, at which the principal speaker was Mr. William P. Rock, executive secretary of the Arkansas Industrial Development Commission.

Mr. Rock told of abundance of resources in the Arkansas area favoring expansion of chemical and allied industries and stated that Arkansas is keeping pace with other growth areas in the attraction of new industries.

MORE THAN 200 OF THE NEW YORK CHAPTER HEAR GENERAL STUBBS

The annual dinner meeting of the New York Chapter, Armed Forces Chemical Association, was held at the Hotel Plaza, New York City, on December 2. Attendance was well over two hundred members and guests of the Chapter.

A cocktail party preceding the dinner was sponsored by a group of chemical companies. Members and guests appreciated and enjoyed the generosity of these good companies.

Mr. James Sheridan, President of the Chapter presided. Colonel Leonard C. Miller, Commanding Officer, U.S. Army Procurement District, New York, spoke briefly. The main speaker of the evening was Maj. General Marshall Stubbs, Chief Chemical Officer, U.S. Army.

THREE CHESAPEAKE MEMBERS WIN PLAQUES FOR RECRUITING

ARMY CHEMICAL CENTER, MD.—Mr. S. Yeardley Smith (left in picture), president of the Chesapeake Chapter, at Chapter dinner October 9, 1958, presented A.F.C.A. plaques to three members for recruiting new members. The recipients, all employees of Army Chemical Center, Md., are (left to right): Mr. William Shearin, Mr. David F. Bourque, and Mr. Henry J. Neibuhr.

$1000 SCIENCE TEACHER AWARD

The Science Teacher $1000 Award Contest, which, for the past three years, has been used by the Armed Forces Chemical Association to encourage and improve the teaching of science in our secondary school system, has been extended for another year. This decision was taken at the last annual meeting of the Board of Directors held in Atlantic City, N. J., and reflects numerous enthusiastic expressions about the award program.

In this contest, the candidates are those science or mathematics teachers who receive the nomination of one of the several chapters of this Association. The nomination is accompanied by a biographical sketch of the candidate, including a summary of his or her achievements as an educator, as a basis for decision by the Committee.

The Committee in charge of the Science Teacher Award is composed of three members of the Association, headed by Dr. Ralph E. Gibson as Chairman. Dr. Gibson is Director of the Applied Physics Laboratory at Silver Spring, Maryland, of the Johns Hopkins University. The other members of the Committee are Lt. Colonel Ovid E. Roberts, Jr., USAR (Ret.), Secretary-Treasurer of the A.F.C.A., and Captain Paul Bauman, USAR, of the Baltimore News-Post.

The data supporting the nomination should set forth cogently and succinctly the qualifications upon which the nomination is based. Since the Committee will base its selection upon the information thus submitted, care should be taken to show clearly the demonstrated ability claimed for the candidate. The records made by the pupils of the teacher, not only while under his direction, but perhaps inspired by his teaching should be cited.

The teacher's utilization of such equipment as may be available, and his general adaptability to the conditions under which he has to work, may prove a means of establishing an appreciation of his ability.

A form is supplied to all chapters to assist them in forwarding and supporting their nominations.

Each chapter is limited to one nomination. The closing date for nominations will be Midnight, July 15, 1959, Headquarters, A.F.C.A.

ARMED FORCES CHEMICAL ASSOCIATION
O. E. ROBERTS, JR.
Secretary-Treasurer

COL. DeLANCEY KING DIED JAN. 6

Colonel DeLancey Rice King, veteran of World Wars I and II and long connected with the Army Chemical Corps, died of a sudden illness at Fitzsimmons Army Hospital, Denver, Colorado, on January 6, 1959.

Born in Lockport, New York, in 1894, Colonel King entered the military service in 1916, served on the Mexican Border and in France in World War I rose to the grade of captain and won the nation's second highest award, the Distinguished Service Cross. During the World War II—Korean Conflict period he served in the Office of the Chief Chemical Officer and as Chief Chemical Officer, Far East Command. He received the Legion of Merit with Oak Leaf Cluster.

DR. HUNTER, QMC RESEARCH DIRECTOR, DIED OCTOBER 2

Dr. A. Stuart Hunter, 61, Scientific Director at the Army's Natick (Mass.) Hq. Quartermaster Research & Engineering Command, died there of a heart attack on October 2. He had held that position since the Command's organization in 1953.

A native of Beachmont, Mass., Dr. Hunter received his B.S. at Norwich University and his Ph.D. at Johns Hopkins University. From 1924-27 he was a research chemist with the Mellon Institute; from 1927-46 he worked in the duPont organization at Wilmington, Del., serving as that firm's liaison agent with the Armed Forces during World War II. In 1946, Dr. Hunter became director of the Army Quartermaster Corps research and development activities.

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EDITORIALS

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JOHN C. MACARTHUR, *Editor*

"PSYCHO-CHEMICAL WARFARE" AND THE CASE OF THE DISCOMBOBULATED CAT

THE U. S. Army Chemical Corps may have something really big in its sights in this new field of military research—"psycho-chemical warfare." That is not an official title but it seems an apt name.

The subject has to do with temporarily incapacitating, or so-called, non-lethal weapons. Non-lethal notwithstanding, this conceivably could be a potent means of subduing an enemy—admittedly, our information in this matter is meager. However, the concept, as we view it, has an inherent, disturbing implication too. This is the danger of possibly serious psychological backfire or feed-back.

It is well known that there is a whole new line of potent items in the biochemical field these days. Now, if the wizardry of modern chemistry can make chemical warfare agents of some of these things so that troops in the field and people in cities perhaps can be put to sleep or otherwise incapacitated en masse by them, even only temporarily, we have here a defense problem which is serious indeed.

There is a big technological difference, of course, between the intricate and delicate processes of making fine chemicals in relatively small lots and the production of warfare agents on a tonnage basis.

As matters seem to stand now it looks like developments in this area are considerably more psycho than chemical. But they would appear to have potentialities for danger even without actual existence of any psycho-chemical weapon at all.

There has been both serious and facetious comment on the news of this project which was so dramatically illustrated with the Cat and Mouse pictures. Some of this has seemed to reflect the idea, if not definite hope, that through such means warfare might be transformed into a contest in which nobody would be hurt—a sort of international boxing match, so to speak.

Each side, presumably, in this thinking, would be arraying its line of tranquilizers, or, what have you, to subdue the adversary; then to move in and capture him. Who would be the super-referee of any such contest to see that Marquis of Queensbery rules—or whatever the new "warfare" code might be called—were duly observed is a question which, apparently, has not yet claimed attention.

Maybe this sounds like a lot of nonsense. And so, we think, it is.

We do not for a moment believe people generally will be unduly impressed by such fantastic notions. Yet, there are seeds of danger here against which the public should be on guard. It is at least conceivable that this could outweigh the advantages of developing non-lethel weapons.

* * *

THE first published information of current interest in the development of temporarily incapacitating but not permanently harmful chemical agents came from testimony of General Creasy at a congressional subcommittee hearing on the Budget last March. Excerpts from this were made available to the press the following May, and the resultant news stories featured, especially, his remarks suggesting as a possible example of such an agent a gas to cause temporary blindness. General Creasy at that time also coined the term "psycho-chemicals." At any rate, that was the first time we ever heard it.

The latest chapter in this matter—with which, it would seem, about everyone in the country is now familiar—is the story about "sleep gas" from New York early in December. It had to do with a brief reference to Army interest in developing non-lethal weapons made in an address at a meeting in New York, December 3, by Major General August Schomburg, Deputy Chief of Ordnance of the Army. General Schomburg was quoted as saying that it would be nice to be able to fight at least part of a war by causing enemy troops to inhale something which would temporarily incapacitate them but do no permanent injury, "possibly just make them sleepy." He illustrated this idea by showing the dramatically impressive Cat and Mouse film, since widely publicized, pertaining to tests of "psycho-chemicals" conducted at the Chemical Warfare Laboratories, U.S. Army Chemical Center, Maryland. The film was subsequently shown over two TV networks and still pictures from it were published in newspapers throughout the country. Indeed, the story of this research project was something of a two-days sensation.

The film first presents a perfectly normal cat demonstrating its prowess as a mouser. In the second sequence, the cat, having now inhaled some psycho-chemical, leaps away in seeming terror when a second mouse is brought before it (pictures herewith). Newspapers featured the idea of an Army "sleep gas" project; although, it might be noted that whatever the cat was

dosed with it could hardly be called "sleep gas," judging from the agility of the cat in avoiding the mouse (Picture 2).

General Schomburg observed that the Army is a long way from anything practical, from a military point of view, in this field.

Scientific investigators, of course, are fully aware that results obtained in a laboratory gas chamber do not conclusively prove practical possibilities for field use. But the general public may not be aware of this fact.

Knowledge of warfare potentialities of many chemical compounds, as well as development of chemistry in all of its phases, has increased vastly since World War I. However, it may be worth noting here, in connection with the Cat and Mouse story, the memorable World War I incident in British chemical warfare history of Professor J. Barcroft and the dog.

The British were confronted with the question of the effectiveness of a chemical warfare agent then developed and being used by the French in artillery shell, known as Vincenite. Its principal ingredient was the deadly substance, prussic acid.

Barcroft contended that, despite its tremendous toxicity, prussic acid was not suitable for war use, holding that an effective concentration could not be obtained in the field. To prove his point, accompanied by a dog, he entered a chamber into which was introduced a concentration of prussic acid in the proportions, according to report, of one part of prussic acid to 2000 of air. This would be 500 parts per million, which would seem to us pretty high. Barcroft remained in the chamber, so the story goes, for one and a half minutes and then came out, apparently unharmed, but he left the dog inside—*dead*. It was found, too, in other scientific study of prussic acid, that it exhibits different effect for different species of animals, even though they are of the same size and weight; that dogs are especially susceptible. In the case of man, the effects are stated to be non-cumulative, there being a certain threshold concentration below which the substance is not effective. This story of Barcroft, incidentally, is not confined to the scientific literature but can be found in published matter of the period intended for general circulation.

It is not for a moment suggested in this discussion that the Army in its research interest in this new field has any false notions or fancies from dreamland as to the essential nature of its business. There is nothing out of line with approved concepts of civilized warfare in seeking to provide, and have available, weapons to incapacitate an enemy temporarily without doing him permanent injury. Probably every war, at least in modern times, has produced situations—for instance, siege conditions, or even just enemy "pockets of resistance," —where such means, if of proven effectiveness, could very likely have served all demands of military necessity. No doubt speculation on possibilities of non-lethal weapons for a broad application of ethical principles in warfare could be carried to some length. But there is a limit. The essence of the meaning of warfare is the readiness and will of soldiers to resort, as necessary, to the utmost in the application of force.

It is pertinent to quote here Lt. General Arthur G. Trudeau, present Chief of Research and Development, who heads up the entire Army Research program. Major General Marshall Stubbs, present Chief Chemical Officer, in his New York speech printed in this issue, also quoted this recent statement by General Trudeau in addressing the Association of the U.S. Army:

". . . . . *the Army must develop the weapons and equipment to win in battle—the means to move, shoot, communicate, and defend ourselves regardless of enemy aircraft or missiles; to close with the enemy ground forces and destroy them if forced into war and then to occupy the enemy homeland pending the establishment of a free government, and thus to control the land.*"

There is no thought of "saber rattling" in our remarks here or purpose to defend warfare as an institution. In modern times the resort to warfare by aggressor nations has been almost universally deplored. We are not concerned in this discussion with that question. Our position here is that the development and use of non-lethal weapons might, on occasion, serve highly desirable ends, but would not, in the main, change the essential nature and meaning of warfare—transform or "purify" it, so to speak.

Before . . .

After . . .

The Army, we think, does well to explore these new concepts fully and to prepare for any eventuality in this area. In these days men are saying that development is limited only by imagination and who knows what might come from this new research project? It is believed the public should be kept generally informed so as to appreciate the dangers involved whether real or imaginary. The Army, in its training of our youth, teaching the use of weapons, and inculcating essential fighting qualities, should not have to contend with any measure of a pre-fabricated, adverse psychology.

• • •

As one dwells upon the implications of "psycho-chemical warfare," insofar as available information permits, he is impressed by a sort of duality, or "double-take" in respect to all aspects of it. It is something like the two sides of the story in the Cat and Mouse incident. As we have noted, on the psycho side, first, there seems to be at least a possibility of the development of erroneous and dangerous ideas about warfare itself. Secondly, there is the matter of the effects which actual psycho-chemical agents might have in the way of "behavorial" disturbances rather than some perceptible physical injury.

And, then, on the chemical side, this matter, viewed broadly, has a dual aspect also. On the one hand, the concept includes, as we understand it, agents having definite physiological and predictable effects. It is in this area, possibly, that there would come such materials for military use as suggested by the newspaper term "sleep gas," or an agent to produce temporary blindness, referred to by General Creasy. On the other side of this two-pronged chemical concept are what General Creasy called the "psycho-chemicals." In his testimony he used the word "discombobulators," in special reference to the so-called nerve gases which may be lethal in their effects. We don't find that colorful term in any dictionary, but it strikes us as an excellent word to apply to the psycho-chemicals also.

It is noteworthy here also that General Stubbs, in his New York speech, mentions the interest of the Chemical Corps in compounds "having a marked convulsant, sedative or incapacitating action."

Incidentally, General Creasy's testimony was apparently not only informative, but also to a degree entertaining, and he was congratulated by the subcommittee for his presentation.

Here is how he described "psycho-chemicals:"

"There is another type of agent we would be greatly interested in. I will call them psycho-chemical agents. They are the ones which will upset your behavior patterns. I use the story many times about the man who on a Monday morning went to see his friend in a hospital. He was in bed with an arm and leg broken; he was all bandaged up, and he said 'What happened?'

"He (the visitor) said, 'Saturday night you got on top of the dresser and said you could fly to the other side of the room, jumped off and didn't make it. You landed on the floor and this is what happened.

"His friend said 'Why didn't you stop me?'

"He (the visitor) said 'Stop you? I was betting on you.'

"The point is that it will do these things to you. You will be acting very irrationally and the other people who have been subjected will not know it, either. Everybody will be on the bandwagon."

General Creasy is well known throughout the Association, but, for the record here and for posterity, it may be well to further identify him. He is Major-General William M. Creasy who retired from the Army last August, and was succeeded, as Chief Chemical Officer of the Army, by General Stubbs.

Considerable publicity was given by the press to General Creasy's testimony on the Budget in respect to this new field of chemical warfare possibilities. He did not go into any detail as to "the state of the art," but gave his opinion that he considered the psycho-chemical program then too small. On being questioned he said then that, even if efforts were multiplied some tenfold, he would not venture a prediction as to when practical developments in this area might be expected.

To carry forward this review of information on psycho-chemical warfare, it is pertinent to quote from two presentations at the 14th Annual Meeting of A.F.C.A., at The Traymore, in Atlantic City, last June 4 and 5. Colonel Ronald L. Martin, Deputy Chief of the Chemical Corps' Research and Development Command, in his speech before the Association, (July-August issue of The Journal), stated in this connection:

"As for new Chemical Warfare agents, we are continually investigating the mechanism of action and applicability of potential compounds whose properties vary considerably. Recent specific developments in this area, which I cannot discuss for obvious reasons, reflect but one prong of a varied attack in our search for new agents. Although some of these agents are necessarily lethal, we have also vigorously investigated other agents which can be used to temporarily incapacitate. The advantages inherent in this type of an approach are widely recognized. I am sure that you have all read with interest the various reports by medical investigators on the effects of these chemicals, known as psychochemical agents, on the human organism. The feasibility of adapting these agents for military operations is being vigorously investigated. Naturally, we have not been limited in our investigations to work on just these chemicals"

And then, at the concluding banquet of the meeting, General Trudeau, the guest speaker, made this most lucid statement:

"The particular field in which your association is most interested—chemical—offers the possibility of very novel approaches. I am especially impressed by the obvious military possibilities of developing non-lethal gases which would incapacitate an enemy without permanently destroying him or the cultural or material symbols of man's progress over the centuries. A start has already been made on this development.

"Another novel approach has been what General Creasy has called a psycho-chemical agent, a type

which upsets behavior patterns. If chemical warfare must be used to retaliate against and rebuff an aggressor, the ability to produce further and temporary irrationality in the enemy would be of inestimable value. Surely both of these approaches envision a degree of humaneness not apparent in nuclear weapons if war again becomes unavoidable.

"Whatever degree of preparedness in the CBR field we now possess and can further develop, the point which needs making again and again is that we must have real CBR counteroffense capabilities if we are not to invite disaster. I fully endorse this view, and have long been an active proponent of expanded efforts in the field you represent."

* * *

NOTHING has been stated, for publication at least, on how "psycho-chemicals" could be most effectively employed—if, as and when, they are developed. Until such information is forthcoming it probably would serve no useful purpose to speculate in any detail on the matter. However, it seems reasonable to suppose that types of protective equipment and measures pertaining to other forms of chemical warfare would be applicable in this case also. At any rate, it is to be assumed that, if any new or additional defensive provisions are indicated, the Army Chemical Corps will be alert and responsive to such needs.

Civil Defense implications of this subject are obvious, and it is to be hoped that publicity given it will bring positive results in that program. This will require keeping the public informed. Indeed in no field of military thinking does there seem to be greater need for keeping the people duly advised of the potentialities, and interested. Here certainly is an area where to be forewarned is to be forearmed.

But, hearken to this!

While we are reflecting on this problem here comes the Secretary-Treasurer of this Association, Lt. Colonel Ovid E. Roberts, Jr., USAR Retired, with a little magazine he has dug out of his archives. It is Vol. 6 No. 10, of the CHEMICAL BULLETIN, published by the Chicago Section of the American Chemical Society. This number of the publication which, incidentally, is still going strong, is over 39—almost 40 years old. It is dated October 1919. It deals with the Chemical Exposition in Chicago in that year, which included an exhibit of chemical warfare munitions and equipment of the period. In charge of that display was none other than our Colonel Roberts—then a Major. And, in an interview reported in this bulletin, he then said:

"After all is considered, if warfare must be resorted to, the ideal type would certainly be a Chemical Warfare in which the gas used would act as an anesthetic for a sufficient length of time for us to take the enemy prisoner after which time he might be persuaded to listen to reason. Surely there would be nothing inhumane in this and yet it would most certainly be Chemical Warfare."

Forty years ago—almost! Well, it remains to be seen what will come out of this idea now.

Anyway, is there anything new under the sun?

THE PUBLICATION OF THE CAT FEARS MOUSE STORY

It is regrettable that in the initial publicity given the so-called "sleep gas" story and the showing of the dramatic illustrative film of the Cat and Mouse experiment no mention was made of the U.S. Army Chemical Corps.

News stories based on the brief statement by Deputy Chief of Ordnance, General Schomburg, about research on non-lethal weapons, referred to the matter simply as an Army project. General Schomburg, the JOURNAL learns, did specifically credit the Chemical Corps in his address, but that was ignored or overlooked by the press.

As for the general public, probably this omission from the news escaped notice entirely.

Such, however, cannot be said of a certain specialized segment of the population, old-timers familiar with the origin and history of the Chemical Corps.

Probably unknown to many of the younger members of the chemical group, in and out of the Chemical Corps, is the story of its early struggles for existence as a separate branch of the Army. But in the initial news treatment of the Cat and Mouse story, many of the old-timers, in mind here, no doubt recalled experiences of the past when the idea of merging chemical warfare activities into some other branch or department was raised. This idea, we believe, has long since been laid to rest. But the thought that it might possibly emerge again has evidently not been entirely erased, as indicated by some reactions heard to the publicity referred to.

It may be noted that there is apparently a tendency now toward emphasizing Army interests in general, rather than special branch concerns in the publicity given to Army developments.

At any rate, it seems that the Chemical Corps, as such, reaped no immediate credit from the initial story of its psycho-chemical agent activity as highlighted by the Cat and Mouse pictures. The psycho-chemical project had, indeed, been given publicity before, but it was the startling film that sharpened public interest.

The program of the Chemical Corps, largely concerned with study of highly toxic materials, has brought many side results in the way of benefits to mankind generally. But here is something which, regardless of what may come of it, has as its underlying motivation the idea of promoting humaneness in the conduct of war. And for that especially, many no doubt feel the Chemical Corps itself should be given all possible credit.

Not a peep has been heard from anyone in the Chemical Corps in the way of complaint over the publicity. It is noteworthy, too, that *Life* magazine, in its account of the matter (issue of December 15) with an array of pictures from the Cat and Mouse film, duly credited the Chemical Corps.

GENERAL STUBBS' NEW YORK SPEECH

(Chief Chemical Officer of the Army presents optimistic view of role and program of the Chemical Corps in address before the banquet meeting of New York Chapter of A.F.C.A., Hotel Belmont-Plaza, New York City, December 2, 1958. Herewith in full, the first major speech by General Stubbs to an A.F.C.A. gathering since his recent appointment.)

WE ARE LIVING in an era in which national defense must be more competent than ever. It is now a battle of technology which cannot be won by the man in uniform fighting alone. It must be everybody's business.

In our planning we must not let the glamour of the space age cloud our thinking as to the reality of what might happen if we were faced with war. We must work toward a balanced concept. Rockets and missiles alone will not win a war, nor can we place too much reliance on the theory that nuclear weapons will supplant all other forms of warfare.

Each one may have a place in warfare but in the final analysis, if war should come, the victor will be the one who has foreseen all the possible avenues that it may follow and has planned accordingly.

In our own thinking, whether we look backward or forward, we find that as General Matthew Ridgway once said: "Man is and always will be the supreme element in combat, and upon the skill, and the courage and endurance and the fighting heart of the individual soldier, the issue will ultimately depend."

In the particular area in which the Chemical Corps operates we are concerned with providing the individual soldier with the means to defend himself should an enemy elect to use any or all of the weapons of chemical-biological-radiological warfare. We must give him the means not only to protect himself but to reply in kind, and in force.

Our potential adversary is determined and ruthless. The Communist threat has increased many-fold since the last World War. You are well acquainted with the Communist campaign to nibble away at the peaceful countries of the world.

Lieutenant General Arthur Trudeau, Chief of Research and Development of the Army recently said in a speech before the Annual Meeting of the Association of the United States Army: "Within the framework of this Communist threat, the Army must develop the weapons and equipment to win in battle — the means to move, shoot, communicate, and defend ourselves regardless of enemy aircraft or missiles; to close with enemy ground forces and destroy them if forced into war and then to occupy the enemy homeland pending the establishment of a free government, and thus to control the land."

We have heard a great deal about the massive size of the Soviet Army, its missiles, its large number of submarines, and its technological progress on many fronts. We have not heard a great deal about the magnitude of their CBR arsenal. This could be ominous or encouraging. But we have heard enough to know that the Communists are very much alert to the potentialities of this form of warfare and give it a prominent place in their preparations.

We would be extremely remiss in our own planning if we did not take into full account the potentialities of these weapons. Let me quote again from General Trudeau's speech: "Chemical and biological warfare is a most vital part of our research. We believe that chemical and biological agents have great potential in any type of warfare. Chemical and biological agents usable against personnel, animals and agriculture, are being carefully studied. Defense against these agents is very difficult but very important and we feel that we must vigorously push this entire program in view of indications of Russian intent to employ some or all of them in war."

General Trudeau's statement is heartening reassurance that our top leaders are very much alert to the dangers of CBR warfare and the necessity that we take positive and forceful action to insure that this country will be prepared.

Pleased With Corps' Work Atmosphere

If there is one philosophy that should govern all our actions it is that we should approach them from the positive side. I have expressed this to my staff and I expect it to be our guiding principle in all that we do. Many of our problems assume a different shape when viewed from the positive angle and the solution becomes easier.

The atmosphere in which we now work is, I believe, the healthiest it has been in years. We cannot, of course, do all that we want to do, and all that we believe should be done. We do not have all the resources that we might like. But this is true throughout the armed services. We can devote only so much of our national budget to defense and still maintain a sound economy.

This means that we must stretch our resources to cover our problems; eliminate the things that we can do without; tighten up our thinking, and sharpen up our programs. The money that we have available must be spent on the things that will do the most for us.

As the new Chief Chemical Officer, it is only natural that people wonder what changes will be made in the organization of the Corps and in its programs. I will tell you what I have told my people. I do not believe in change for the sake of change. It is possible that some readjustments in the organization may be advisable in the light of changing conditions and changing needs. Where these are indicated I will make them, but only after I have had an opportunity to make a thorough study in order to determine what is needed.

The Chemical Corps must have a dynamic organization. We must have the people and the organization capable of meeting any challenge with which we must be faced, and we are facing some new ones.

One of these is in the area of radiological warfare. From time to time you have heard what we can tell you about chemical and biological warfare, but not much has been said about the R part of CBR, radiological

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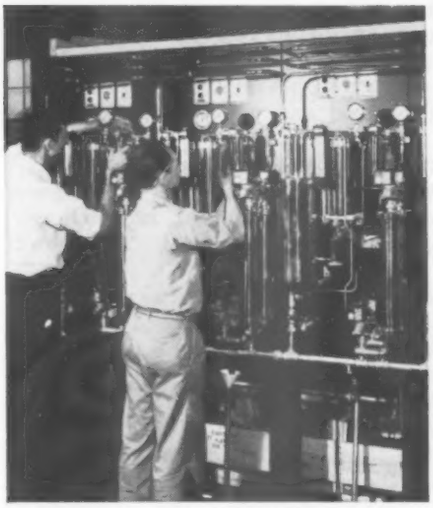

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warfare. We have had responsibilities in radiological warfare and have done a great deal about them, but recently our mission has been put into sharper focus.

Aside from the problem of what happens when a nuclear weapon hits the target, the Army is very much concerned with the problem of not only fighting, but surviving in radioactively contaminated areas. We must learn to live with this problem and find methods by which our troops can go on fighting under such conditions.

The problems that we encounter in the field of radiological warfare affect every arm and service, every person and every bit of equipment that goes to make up an Army.

So that you will better understand what I am talking about, let me give you the official Army definition of radiological warfare.

"It is the employment of agents or weapons to produce residual radioactive contamination as distinguished from the initial effects of a nuclear explosion (blast, thermal, and nuclear radiation)." This could be done by scattering radioactive particles over the target.

"Radiological defense encompasses defensive measures to be taken against radiological warfare and initial nuclear radiation."

In a recent clarifying restatement of our mission in radiological warfare the Chemical Corps has been designated as the responsible technical staff agency of the Department of the Army for the conduct of radiological warfare and radiological defense. This includes research and development not assigned to other services, and the development of technical doctrine. We also are charged with the determination of requirements for the basis of issue of equipment in conjunction with the combat development system, and provision of technical staff and field guidance.

Rad-Warfare Experts for the Army

We also were told that the Chief Chemical Officer should take all necessary steps to insure that our chemical officers are trained to become experts in the radiological warfare for the entire Army.

The Chemical Corps stands to make a considerable gain in stature and prestige if we carry out this mission efficiently.

As a first and immediate step in consonance with the directive that we become experts in radiological warfare, we established a short RW Orientation Course at the Chemical Corps School at Fort McClellan, Alabama for our senior chemical officers and key civilians of the Corps. A course in radiological safety has been established at the School for safety personnel. Methods of conducting radiological surveys and monitoring, principles of fallout prediction and the operation of a radiological center are also taught as part of other courses at the School.

We now have a small radiological training area at Fort McClellan which is used by all three military services for ground and aerial survey.

In addition, we are planning to establish a radiological testing facility at the Chemical Corps Proving Ground at Dugway, Utah to provide a realistic facility simulating the fallout fields which may occur in nuclear war. This facility will enable us to study the effects of radiation in the bio-medical and radio-biological fields and to conduct research in shielding.

We are also establishing at Dugway a high-level CBR weapons orientation course which will be similar to the Weapons Orientation Advanced Course at Sandia Base, New Mexico. We expect this new school to be in operation early next summer.

In the discharge of our responsibilities in this area it will be necessary to accumulate basic information on all aspects of nuclear radiation phenomena, and to develop the procedures, techniques and equipment needed to cope with radiological hazards. This information must be provided to other Department of the Army agencies, particularly military planners, doctrine and training agencies so that the combat arms can be thoroughly trained and equipped to maintain an operational capability under nuclear warfare conditions.

One of our immediate problems is to provide an effective tactical dosimeter for field use which will detect and record the gamma-neutron dosage received by personnel exposed to the effects of a nuclear detonation. Such information is required by a military commander to determine the fitness of his troops to undertake tactical operations following exposure to nuclear radiation. This information also will be used as a basis for planning for replacement, evacuation and treatment of radiation casualties.

The Corps has been conducting research and development on a chemical gamma-neutron dosimeter and has made considerable progress. A system has been selected and partially tested and we are expecting delivery of an initial order this fiscal year.

For some time we have had the responsibility of disposing of radioactive waste material from Army programs., We need to develop economical, safe and reliable methods of disposal of this material. This is not an easy problem.

The present method of disposal is to encase the material in concrete and bury it at sea beyond the 1000-fathom line. We are not satisfied that this is the best, nor the ultimate method. It is expensive, does not permit reclaiming potentially valuable material, and does not place it where it can be controlled. There are many agencies, both in the United States and abroad, which are concerned about the continuance of sea burial and are investigating better methods. The increasing amount of radioactive material generated by or used by the Army increases the importance of this problem.

We also have the problem of developing equipment, techniques and procedures to permit Army personnel to handle radioactive material within safe dosage limits.

Stresses Value of Industry's Help

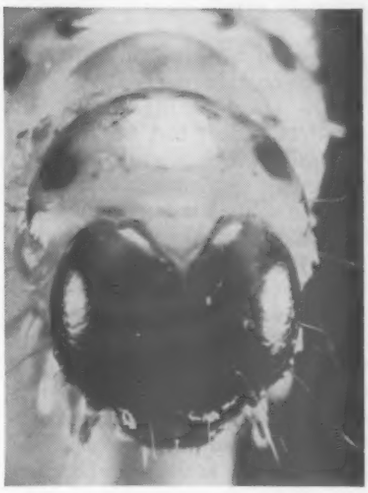
We naturally expect to encounter many problems in the discharge of our radiological warfare mission. We expect that we will find many of the answers through our close relationships with industry, educational institutions and other places outside the military establishment. I say this because the Chemical Corps has first-hand knowledge of the tremendous amount of help available to the military services just for the asking.

We have asked for help on many occasions and have gotten it without hesitation and without reservation. There are examples, without number, of how industry, science and engineering have contributed immeasurably to solving problems confronting the military.

We have a special program designed to enlist the assistance of industrial and educational laboratories throughout the country. Some of you may know about this program. This is of extreme importance to us. It is concerned with the search for new compounds or new ideas about old ones which may have application in the field of chemical warfare.

There was this thought in our minds: Research in civilian institutions and laboratories is conducted for

Specialist!



This handsome fellow specializes in "inside jobs." He's the corn borer. He may not be the ugliest insect known to Agriculture, but the damage he inflicts ranks him right up there with the worst.

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other purposes than warfare; yet in the course of such research new processes, new compounds, or new leads, often appear which do not have conceivable application to civilian uses. They may have no financial value to industry and may be discarded. Often such compounds may be too toxic for civilian use, or may have extremely undesirable physiological effects. Industry cannot use them, but they may have military possibilities. We want to find out about them.

Some of the general areas in which we are interested include the following:

1. Compounds which have an adverse physiological effect; those having a marked convulsant, sedative or incapacitating action. We are also seeking compounds which have a harassing effect which can be used for training. These are compounds which would not cause harm but would be sufficiently unpleasant to leave a marked impression so that the soldier being trained will remember it and do automatically what is required of him. It doesn't do any good just to tell him about these things. He must learn by experience.

2. In the second general area are those compounds which have therapeutic or prophylactic value. This group covers the whole range of interest concomitant with the effects of chemical warfare agents.

3. In the third general area are those substances, compounds or mixtures having specialized properties such as gelling, thickening, decontaminating and smoke producing.

4. The fourth and last area involves the detection of chemical warfare agents and nuclear radiation and the protection and decontamination of personnel or material exposed to their effects.

Our files today contain several thousand structures, suggestions and ideas received from non-military laboratories. It would be impossible to estimate how many million of dollars worth of research these represent.

Of the 3000 industrial laboratories in the country, approximately 430 are now participating in the program. We are receiving information at the rate of about 500 items a month. We are getting ten dollars worth of information for every ten cents we spend. An important result of the program is that, by knowing what types of research are being performed in industrial laboratories we can prevent duplication of the same research in our own. It also gives us the immediate benefit of outside research which has not yet been published.

The commercial interests of the laboratories furnishing us this information are fully protected. Only a very few of our people know where the material originates. When it comes in we remove the name and assign a number. The name is locked up and stays locked up unless there is a valid reason for one of our people to know it. In addition, patent rights of the civilian laboratories are fully protected.

Those submitting samples of material to us are furnished an unclassified screening report and are kept informed as to the disposition of the suggestions and ideas sent to us. In many cases we can furnish information on safety procedures to be used in the handling of hazardous materials. In addition, we are glad to have laboratory representatives visit our people and talk over mutual problems. This can be valuable, particularly when a laboratory is exploring potential uses for a new product.

Describes Some Recent Developments

I should like to be able to tell you all the things the Corps is doing. It would be good news to you. I believe it would be very reassuring to those of you who work closely with the Corps and are concerned about its future.

There are a few recent developments which I can tell you about. These are primarily connected with our support of the man with the rifle—to give him better and more effective equipment.

The one-shot portable flame thrower is a recent development for use in close-range combat situations such as were encountered in World War II and Korea. It is particularly effective for the reduction of bunkers and other emplaced positions where high explosives are not effective.

The weight of the flame thrower loaded is approximately one-third that of the currently standard multiple-shot portable flame thrower, and the range is about the same. This can increase the combat effectiveness of the infantryman since any soldier could be equipped with flame as a weapon in addition to his standard infantry weapons.

In advanced stages of development is a lighter-weight multiple shot flame thrower. We have knocked about 20 pounds off the weight. This is something which the soldier who carries one on his back can best appreciate.

Also in the field of flame is a flame thrower unit which can be mounted on a variety of combat vehicles. The assembly consists of fuel units which are connected in series by means of quick-connect couplings to allow rapid assembly and disassembly.

We are working on a new fire rocket to give added range to flame support of the combat soldier. This rocket will reach areas not possible for flame throwers, and will not be affected by weather conditions which would ground aircraft carrying fire bombs.

The new rocket is effective at ranges of from 500 to 3,000 yards. A barrage will engulf a selected area, since the flame from each munition covers an area 25 yards across.

The warhead of the rocket consists of a heavy cardboard container filled with about five and one-half gallons of thickened fuel, propelled by a rocket motor.

The Corps has recently developed a new aircraft smoke tank which for the first time permits jet planes to lay down a smoke curtain. The development of the new method of laying a screen was made necessary by the increase in plane speeds with the advent of jet aircraft. With the vast increase in speed, the rush of air broke the liquid into small droplets—causing the smoke to hang suspended in the air instead of falling to the ground as a protective screen. The new tank produces a cloud which is free of the gaps and rifts common to other screens. It can form a complete curtain from 500 ft. to the ground in about 25 seconds, as compared to from 5 to 25 minutes for other types.

The tank is filled with small containers loaded with a standard agent. After these are placed in the tank, more smoke agent is added, filling in the dead spaces around the small containers.

When the tank opens, two effects occur at the same time. The agent in the dead space immediately forms an airborne cloud, and the small containers fall to the ground. Some of these containers release smoke as they fall. Others do not open until they hit the ground. In all there are three clouds—one at release height, another at ground level, and a connecting section between. The result is a high and solid vertical curtain from plane to ground.

In our biological research there have been a number of developments which, while conducted for military purposes, have widespread applications for the general benefit of mankind. One of these was the development of an improved method of sterilization of rooms, or even entire buildings, with beta-propiolactone which can be

used where other types of gaseous sterilants would have undesirable side-effects.

Experimental studies at Fort Detrick have indicated the possibility of the sterilization of sewage or waste by irradiation. It was concluded that a nuclear reactor might be used to sterilize sewage for as little as one-quarter of a cent per gallon, while at the same time it could be used as a source of heat or electrical energy. In addition the waste could be used as a secondary coolant and would pass between the reactor and the thermal shield rather than through the reactor core.

Experiments have also been conducted to determine the value of ozone as a sterilizing agent for sewage and waste with promising results. It has also been determined at Fort Detrick that preparation of a combined toxoid to immunize against the five known types of botulinum toxin is now possible. Laboratory animals have been successfully immunized with the preparation and indications are that this toxoid will be successful in humans. This is the first time that a purified toxoid capable of simultaneously immunizing against all five known types of botulinum poisoning has been developed.

I could cite a great many other examples. It is a somewhat curious, but gratifying, fact that many of our developments in chemical, biological, and radiological research do contribute heavily to health, welfare, safety and better living. These are by-products of work carried out in the performance of our primary mission.

Technically Trained Officers Needed

One of our greatest concerns at the present is a problem on which we need all the help that we can get. We are short on officers. The Chemical Corps needs officers with a technical and scientific background and they are difficult to find. At the present time our officer strength is approximately 100 less than our current authorization of 1331, and in the foreseeable future the trend appears to be downward. The impact of this upon the accomplishment of our mission is obvious.

We are making a concerted effort to encourage worthy junior officers to continue their careers in the service and apply for a Regular Army commission. We need a continuing influx of young officers with good minds, a willingness to work, to study and to learn, so as to be ready for greater responsibilities.

While the Corps, like most other branches of government, cannot compete too successfully from a monetary standpoint with industry, it can offer many rewards in professional recognition and job satisfaction.

All branches of the Armed Forces and various departments and agencies of the Federal Government rely on the Corps for many services in the chemical, biological, and radiological field. This means that we must have men with above average training and capabilities.

I have touched on only a few phases of our recent activities and developments. Time will not permit me to go into more detail. Since you have such a deep interest in the Chemical Corps, I feel it important to keep you informed as to what we are doing. There are a great many things to be done, but with help and encouragement of groups such as you I have no doubt as to the successful accomplishment of the responsibilities assigned to us.

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DETERIORATION OF MATERIALS AND EQUIPMENT

By **C. J. WESSEL,** *Director*

Prevention of Deterioration Center*
Division of Chemistry and Chemical Technology
National Academy of Sciences-National Research Council

THE CRITICAL requirements of warfare often serve to focus attention on disciplines which otherwise might remain undefined and unorganized for generations. Technological developments of great usefulness in peacetime are many times born or highly developed during war. Outstanding among such developments are atomic energy, the seven-league step of aviation into space flight, and several new modes of detection and communication.

Not as spectacular, but of unchallenged strategic and economic importance, has been the genesis and development of the field now commonly known as "deterioration prevention."

In 1940, worldwide political conditions and the threat of war made the deterioration of materials a matter of strategic importance in American defenses. The climatically and geographically widespread battlefields of World War II imposed environmental conditions on materials which had never before been encountered on a large scale. These climatic factors led to deterioration of essential materials and equipment at a rate and magnitude which was totally unexpected. Equipment with an estimated service life of months or years became inoperable in the tropics, for example, in weeks. The gravity of the deterioration situation which developed in terms of the Armed Forces, is a matter of record.

The profound nature of the military maintenance problem caused by the climatic extremes encountered and the need for rectification was quickly recognized by certain Navy, Army, and civilian scientists. This led to the formation of a Joint Army-Navy Deterioration Steering Committee. With its sub-structure this group analyzed the needs of the armed forces and determined means for satisfying these requirements. To provide the information requirements of the problem, after the establishment of the Office of Scientific Research and Development, the Tropical Deterioration Information Center was established in 1943 at The George Washington University.

By the close of World War II, activities in the field of deterioration prevention had clearly demonstrated their continuing usefulness and in 1945, the Office of Naval Research (then the Office of Research and Inventions) recommended a more permanent organization. Thereafter the functions of the Steering Committee were transferred to a new Joint Army-Navy Deterioration Prevention Committee; the effort at The George Washington University was reconstituted as the Prevention of Deterioration Center with headquarters at the National Academy of Sciences-National Research Council. Both the Army and the Navy contributed to the financial support of the Center and later, with the formation of a separate Department of the Air Force, it too added its sponsorship. The general support arrangement for the Prevention of Deterioration Center and services provided by the organization have remained essentially unchanged to the present day, attesting to the wisdom of the original planners and the continued usefulness of such an information center.

Although the experience of the Armed Forces has provided many dramatic examples of deterioration, civilian losses are at least as large and often equally serious. Industry pays heavily for deterioration, and the home-owner is confronted with one or another aspect of the problem almost daily. Consciously or unconsciously, it is commonly appreciated that iron and steel structures rust unless regularly and adequately protected; textile materials are attacked by mildew or insects; rubber and leather goods become hard and crack; wood decays unless appropriately treated.

A few years ago a conservative estimate of losses due to deterioration set the total figure at $12 billion annually. The lower value of the dollar would make a realistic estimate today considerably higher, probably in the neighborhood of $15 billion annually. The cost of corrosion alone is estimated at about $8 billion. American railroads replace over 40 million ties a year at a cost of about $4 per tie. Termite damage costs the United States about $100 million annually. Corrosion of oil refinery equipment has been estimated to add 1 cent per gallon to the price of gasoline. Loss in buried pipe due to corrosion is placed at from $50-$600 million. Yearly losses from marine borer attack on wooden structures around the United States amounts to at least $50 million. Annually it costs $225 million to replace lumber destroyed by decay, exclusive of labor. Annual United States loss due to moth damage of fabrics amounts to anywhere from $100-$500 million. The annual loss caused by rats and other rodents is estimated to be between $1-$2 billion, including foodstuffs. About $500 thousand are spent annually for preservatives for water-base paints, another $500 thousand for preservatives for leather finishes, and about $5 million for slime control in paper mills. It has been estimated that we now have a total of 1.5 billion tons of steel and iron products which have gone into the building of our industrial and domestic facilities. It has been further estimated that about 2.5 per cent of all steel and iron in use corrodes away every year. This amounts to 37.5 million tons, or approximately ⅓ of our national output.

To present some idea of the quantities of materials and equipment involved in the operation of the Defense Department and other government agencies, it was estimated about two years ago that DOD has approximately $51 billion worth of equipment and materials in storage and $53 billion worth in use, or a total of about $104 billion. This was estimated to be increasing at the rate of about $15 billion annually. The stockpile of strategic and critical materials maintained by the General Services Administration has a maximum objective of $11 billion with a minimum of about $6.5 billion. As of October 1956, the Maritime Commission had a total of 2,057 ships in its eight reserve fleets. The

(Continued on page 16)

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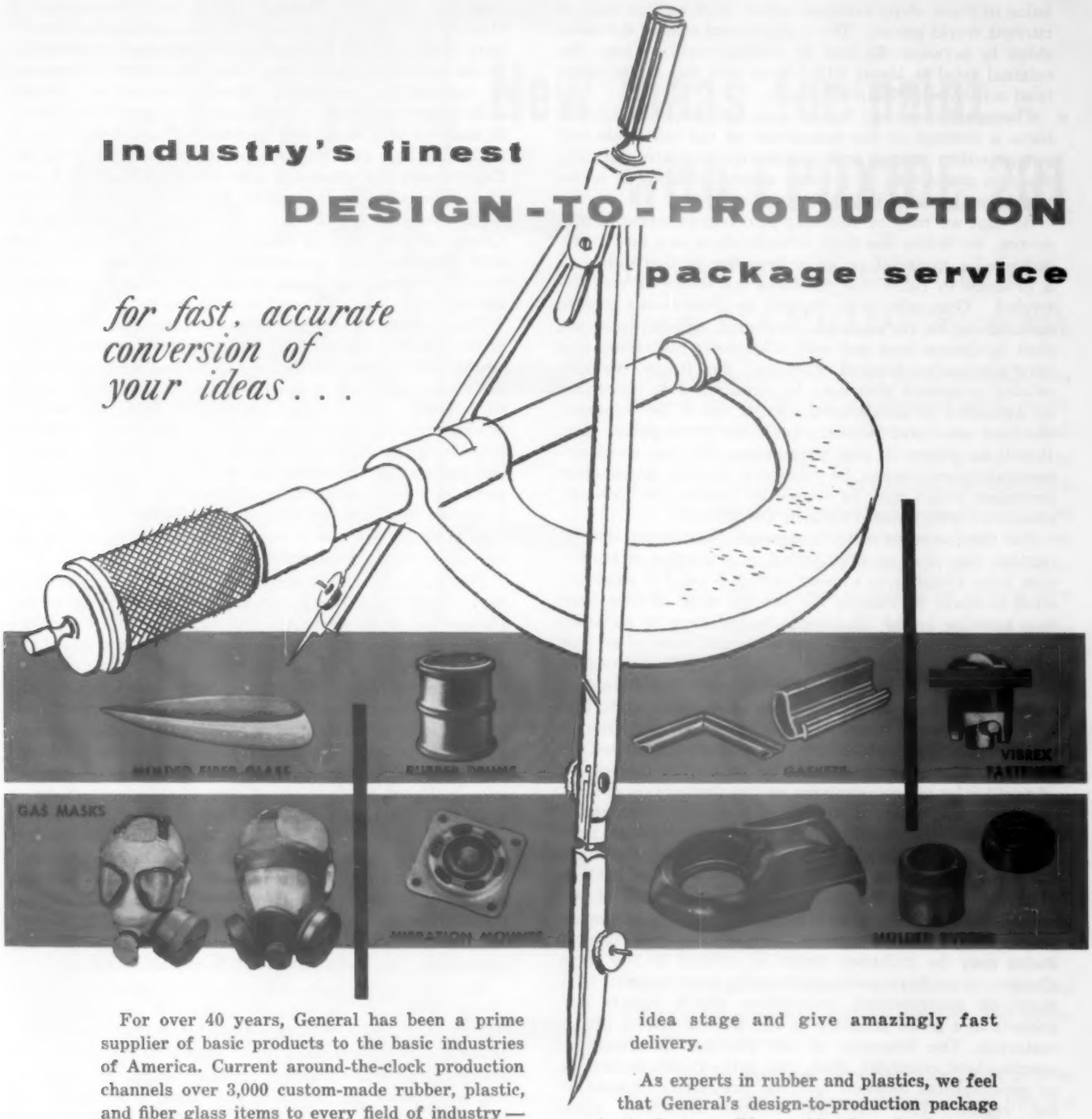

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value of these ships averages about $1.25 million each at current world prices. The replacement cost of the same ships is between $3 and $4 million each. Thus, the original total is about $2.5 billion and the replacement total is between $6 and $8 billion.

These astronomical figures are quoted to bring into focus a concept of the magnitude of the materials and equipment in storage and in use which require the ultimate in protection to prevent almost staggering losses which can be caused by deterioration.

So that we may be thinking in common terms of reference, we define the term deterioration as a loss in the value of a material or as a decrease in the ability of a product to fulfill the function for which it was intended. Generally it is limited to impairment due to natural causes, for example, biological agents, moisture, dust, moderate heat and cold, ultraviolet radiations, and slow electro-mechanical reactions. But it also includes related processes that may be considered to constitute an extended or accelerated natural cause, for example, the heat generated within a radio set by its power unit. It will be shown in our conclusions that the word deterioration may futher be defined to include degradative processes which may be caused by factors not normally associated with natural climatic conditions.

For the purposes of the immediate discussion, deterioration may also be interpreted as a process of transition from a higher to a lower energy level. For example, steel is made by raising the energy state of iron from that existing in the chemically bound state or an oxide ore to that existing in the free elemental state of an iron or steel beam. The energy here is supplied from an outside source, as by the burning of coal. The elemental state in this case is not, however, the stable state and there are always forces tending to cause reversion of the iron to the chemically bound state represented by rust. Similar examples could be drawn for the rotting of textiles by microorganisms, or the destruction of rubber by ozone, wherein, in each case energy changes associated with polymerization and depolymerization prevail. For practically all forms of deterioration physical-chemical phenomena can be considered as being basic.

In the common frame of reference, the total of the so-called forces which tend to cause changes in energy level or reversion to stable though sometimes useless states may be included under or related to the term climate, or perhaps more universally, environment. Climate or environment determines which agents are present in a given situation to shorten the useful life of materials. The intensity of the physical deteriorative agents—heat, sunlight, dust, and grit—varies according to geographical location and the prevailing climate of the region. The chemical agents—moisture, salts, alkalies, and gases—are likewise dependent upon climate or industrial effluents for the intensity of their action. The biological agents—fungi (molds), bacteria, insects, and marine organisms—all depend on the existence of optimum humidity, temperature, and nutrients to thrive in an active, destructive way. Heat, sunlight moisture, wind, and dust might be called prime factors of deterioration. The biological agents are secondary, or may even be considered as corollaries to the chemical and physical agents, since possibly their very existence in a given area, and certainly the intensity of their effects, are dependent upon the prime factors.

The Prevention of Deterioration Center is organized in a fashion such that it can serve in the capacities of consultant, advisor, information center, publisher, liaison representative, and conference host to the Department of Defense in matters pertaining to deterioration and its prevention. Under the National Academy of Sciences-National Research Council policy, the Prevention of Deterioration Center, a project of the Division of Chemistry and Chemical Technology, is supported scientifically by an Advisory Committee. This committee is composed of outstanding scientists, chosen because of proven ability in their fields, and organized to guide the Center in matters of science and technology. Advice on fiscal problems, and matters pertaining to relations with the Department of Defense, is provided by a Service Technical Committee composed of representatives from the Air Force, Army, and Navy. The permanent staff of the Center is composed of about 25 full time or part time staff members and consultants covering the necessary scientific disciplines, abstract preparations, translations, editing, and secretarial and clerical work.

The consulting, advisory, and informational services of the Center focus largely on handling requests from the Department of Defense which may vary from simple questions requiring only an answer by telephone or by correspondence, to long term studies of special aspects of deterioration and its prevention. This work is facilitated by an information handling service which acquires and indexes or otherwise codes many thousands of reports in the field annually, and makes the information available on short notice when required. The service also provides for the preparation of reports and bibliographies in specialized fields.

The publishing activities of the Center, for the most part, reside in the preparation and dissemination of the Prevention of Deterioration Abstracts. This is a publication, now in its 16th volume, which scours world literature, government reports, contract reports, and all available literature in the field of deterioration, abstracts the most important documents, and further provides bibliographic and telegraphic key word announcements of the remainder. Language barriers are reduced by the provision of English language abstracts of many foreign language reports. Other publication efforts of the Center include a textbook published in 1954 entitled "Deterioration of Materials, Causes and Preventive Techniques," summarizing the general knowledge available in the field up to that time; conference proceedings; the PDC Newsletter, a quarterly publication distributed throughout the world; special listings of reports in such fields as microbiological deterioration; and papers of specialized interest in the open scientific literature.

The scientific liaison and industrial relations services of the Center call for the maintenance of liaison between the various government laboratories, industrial organizations, private research institutions, universities, and scientific societies through representation on committes, attendance at scientific meetings, organization of technical conferences, and personal contacts.

In summary it may be said that the Prevention of Deterioration Center, a Department of Defense supported organization, of the NAS-NRC, attempts to act as a hub around which studies in the field of materials and equipment deterioration and its prevention may be built. To this end it provides an information service which gathers and disseminates worldwide reports of work in the field. With this information at hand and with the experience of its Scientific Advisory group and permanent staff, the Center then provides consulting and advisory services on problems of deterioration as they arise in the Defense Department. To further implement this work the worldwide literature reports are made available in the form of abstracts or extracts to the using services. Many summaries of information are prepared, conferences held, and publications issued.

(Continued on page 30)

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WEST WITH AN ARMY CHEMIST-EXPLORER

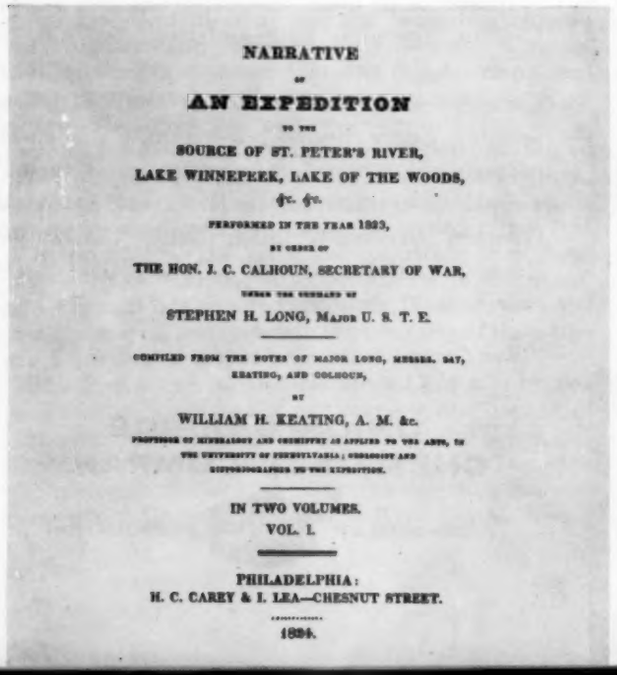
By WYNDHAM MILES, Ph.D.

U.S. Army Chemical Corps Historical Office,
Army Chemical Center, Md.

THE AMERICAN ARMY has taken an interest in chemical warfare for only forty years, but it has employed chemists on special occasions since the Revolution. Back in the 19th Century one of the jobs that the government passed along to the Army was the exploration of the West. A shelf of books could be written about the soldiers who journeyed into uncharted country facing the dangers of nature and the enmity of hostile indians to erase unknown areas from the map. In the course of these expeditions the Army made a point of collecting information on natural history, often sending civilian scientists along for that purpose. Geological and mineralogical data were especially useful since they allowed an estimate of natural resources of unsettled land; and at that time, when science had not reached its present high degree of specialization, chemists with their knowledge of inorganic substances, ability to analyze rocks, ores, and minerals, familiarity with the fundamentals of geology, and awareness of the industrial applications of raw materials, were particularly suited for exploring parties. This is the story of one of these chemist-adventurers, a young man named William Keating who left a soft job at the University of Pennsylvania to journey with Major Stephen Harriman Long into the Indian territory we now call Minnesota.

Mineralogist, chemistry professor, explorer, mining engineer, politician, lawyer, and railroad executive; each of these things was Keating at one time or another in his short life of forty years. Born in Wilmington, Delaware, in 1799, and liberally educated at the University of Pennsylvania, he studied chemistry, mineralogy, geology and mining engineering in Europe. When he returned from abroad around 1820 he was certainly one of the best educated scientists in the United States; yet he could not find a job. The employment situation was much different than it is today. Industry had not yet learned the value of scientists in research, development, and production, and only a few universities had professors of chemistry. Keating spent his time collecting and analyzing minerals, publishing papers, and writing a small monograph on mining. Then in 1822 his first break came when the University of Pennsylvania elected him Professor of Mineralogy and Chemistry as applied to Agriculture and the Arts. Teachers today think they are undersalaried, but listen to this; the only pay that Keating received was a fee from each student attending his classes, and back in those days when professional chemists were as scarce as hen's teeth, he certainly would never have gotten rich. His course is interesting historically because it was one of the earliest attempts in the United States to teach chemistry by laboratory instruction. At that time practically all other courses here and in Europe were taught by lecture, without any student experimentation whatsoever.

KEATING scarcely had time to get his course in shape when Major Long, U. S. Topographical Engineers, arrived in town. On his heels came a letter from Secretary of War John Calhoun telling him to assemble an expedition and explore the land lying betwen the Red River and Lake Superior, along the Canadian border. Long was already widely known for his explorations of the West. Back in 1816 he had been pushing a chalk across a blackboard at the Military Academy, teaching mathematics to cadets. Then the Army had sent him to survey the portages of the Fox and Wisconsin Rivers, and had opened up a new career for him. Upon completion of his mission the War Department ordered him to voyage along the upper Mississippi, sketching its course, noting its topography and choosing sites suitable for military establishments. In 1818 when Congress authorized the so-called Yellowstone Expedition to establish a military base at the mouth of the Yellowstone River, Long led the scientific section of the party. After the expedition came to an end the following year because



NARRATIVE

OF

AN EXPEDITION

TO THE

SOURCE OF ST. PETER'S RIVER,

LAKE WINNEPEEK, LAKE OF THE WOODS,

&c. &c.

PERFORMED IN THE YEAR 1823,

BY ORDER OF

THE HON. J. C. CALHOUN, SECRETARY OF WAR,

UNDER THE COMMAND OF

STEPHEN H. LONG, MAJOR U. S. T. E.

COMPILED FROM THE NOTES OF MAJOR LONG, MESSRS. SAY, KEATING, AND COLHOUN,

BY

WILLIAM H. KEATING, A. M. &c.

PROFESSOR OF MINERALOGY AND CHEMISTRY AS APPLIED TO THE ARTS, IN THE UNIVERSITY OF PENNSYLVANIA; GEOLOGIST AND HISTORIOGRAPHER TO THE EXPEDITION.

IN TWO VOLUMES.

VOL. I.

PHILADELPHIA:

H. C. CAREY & I. LEA—CHESNUT STREET.

1824.

WILLIAM H. KEATING

Picture reproduced by permission from a drawing in the library of The Franklin Institute, Philadelphia.

of inefficiency and the consequent refusal of Congress to appropriate additional funds, the Army did not disband Long's scientific party but ordered it to ascend the Platte River to its source and then return to the Mississippi by way of the Arkansas and Red Rivers. Thus in seven years Long had exchanged the sedentary life of a mathematics teacher for that of one of the most active explorers of the West.

It was the month of April, 1823, when Long's orders arrived, rather late in the year for him to start into the wilderness and get back out again before the snows of winter locked him in. Fortunately Philadelphia was one of the scientific centers of the country and Long had little delay in finding qualified companions. Within a few days he had signed on Thomas Say, a noted naturalist who has been called "the father of descriptive entomology in America"; Samuel Seymour, a well-known landscape painter; and Keating, who jumped at the chance to study the geology and mineralogy of the region. Washington sent James E. Colhoun, astronomer and topographer, to join the group in Ohio. Edwin James, an Army surgeon and expert botanist, was directed to accompany the expedition, but orders did not reach him in time.

Five days after hearing from the Secretary of War, Long had his men in carriages headed west. At Wheeling they took to the saddle and continued on through Ohio, Indiana, and Illinois. Chicago, in Keating's eyes, consisted of a "few huts, inhabitated by a miserable race of men, scarcely equal to the Indians from whom they are descended. Their log or bark houses are low, filthy and disgusting, displaying not the least trace of comfort." At Fort Crawford, where the Wisconsin River joins the Mississippi, troops from the garrison reinforced the expedition which then split temporarily into two groups; one sailing up the Mississippi to St. Peter's River (now the Minnesota), the other riding overland. Meeting at Fort Snelling, on a spot now between Minneapolis and St. Paul, the party picked up a new escort of officers and men and then journeyed across Minnesota to the Red River. The Indians along the way were generally peaceful, but near the Red River the explorers ran into a Sioux war party that camped only a short distance away. Outnumbered three to one the men readied for a fight. When it did not come Major Long, who knew the Indian custom of attacking at dawn, waited until midnight when the moon was up and then led his group off across the prairie. By daybreak they were out of reach of the warriors, miles away from their campsite of the previous evening.

CANOES took the place of horses on the marshy upper reaches of the Red. Long's instructions, drawn up by someone sitting at a desk, told him to turn at the Canadian border and head east to Lake Superior. But Indians and trappers who roamed the region in search of fur for the Hudson Bay Company warned him of the difficulties of an overland march, and persuaded him to continue onward by water. The party thereupon paddled north through British territory into Lake Winnepeg, then southeast through Lake of the Woods and Rainy Lake to Lake Superior. For two weeks the party made their way along the northern shore of Lake Superior in an open boat, buffeted by storm and gale, until it reached civilization at Sault Ste. Marie. Here the expedition disbanded, Long and the scientists travelling by steamboat and revenue cutter to Niagara, and thence by canal boat and carriage to Philadelphia. Keating reached home in October after an absence of six months and a journey of 4500 miles. He drew up an account of the exploration and published it the following year under the title, *Narrative of an Expedition to the Source of St. Peter's River, Lake Winnepeek, Lake of the Woods, &c. &c. performed in the year 1823. . . .*

Keating's *Narrative* attracted a host of readers. A British publishing house reprinted it in London in 1825, and again in 1828. A German firm translated and issued it at Jena in 1826. Reviewers gave it considerable space in magazines.

About three-quarters of the *Narrative* was a straightforward chronological account of the expedition from the day it left Philadelphia until it came to an end at Sault Ste. Marie; the remainder covered the geography and natural history of the region. Keating described the towns and important industrial establishments of the civilized areas, the physical features of the country side, the wild life of the plains, the climate of the unsettled regions, and the culture of the Indians. Although the men travelled rapidly they found time to collect minerals, insects and plants, and skins of animals, birds and reptiles. Keating analyzed some of the minerals in his laboratory at the University, giving the results in the volumes. On the Canadian side of the St. Mary's River he discovered the Bruce copper mine, famous in the copper rush of the 1840's.

For twenty-nine years the *Narrative* remained the only geological report of this section of the United States, until David Dale Owen undertook a detailed geological survey of Wisconsin, Iowa, and Minnesota for the government in the 1850's. It was the first authentic exploration to the source of the Minnesota River.

The part of the *Narrative,* however, that has had the most lasting value is that which describes the culture of the Indians of the region. Keating's contemporaries immediately recognized the importance of this material. Jared Sparks, great American historian, in reviewing the book, wrote that "among the most interesting researches, contained in these volumes, are those relating to the aboriginal inhabitants of the countries adjoining our frontiers." Joseph Sabin, in his monumental *Dictionary of Books relating to America,* considered the work "almost a cyclopedia of material, relating to the Indians of the explored territory. Nothing escaped the attention or record of the gentlemen who accompanied the expedition; and their statements respecting the Sioux and Chippeway tribes are among the most valuable we have."

HOME in Philadelphia Keating settled down until 1826, helping to organize the Franklin Institute where he taught chemistry, and editing an elementary text, *Conversations on Chemistry.* Then a Mexican firm called him to direct engineering operations at the silver mines near Temascalapa. Four years were all he could stand of this profitable but lonesome employment before he headed home. Unusual as it may seem for a man of Keating's background he was deeply interested in politics. He ran for the state legislature of Pennsylvania, won the election, served for two years, and was asked to run for congress. Instead he shot off at a different angle. Political office had gotten him interested in law. He studied and was admitted to the Bar in 1834. He built up a lucrative practice, but in the meantime found a field that was much more congenial to his taste; the railroads. The American boom in railroads was just starting, with financiers, businessmen, and speculators trying to get in on the ground floor. Keating, an engineer, lawyer, and politician, with drive and ambition, was ideal to fill an executive position in the new industry. A small Pennsylvania line elected him president, and a few years later the Reading Railroad elected him

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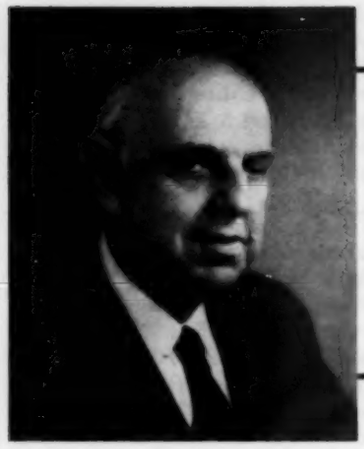

DEFENSE CHEMISTRY

By WILLIAM T. READ, SR.

The larger part of the material in this section has been obtained from releases of the Office of Technical Services, which handles publications of all Government Defense Agencies. Several reprints have been furnished, which are also quite helpful. Acknowledgments with thanks are made to *Chemical Week* and *Chemical Engineering News* for items that are of military interest.

The varied character of the paragraphs in this section makes it vulnerable to the criticism that Mark Twain made of the dictionary, that it changes the subject quite often. To bring like topics together as nearly as possible, an arbitrary division has been made into eight general headings, even though the connection between some of the items may not be too obvious. W.T.R.

RESEARCH AND SURVEYS

Carbon black has proved to be a most versatile material in both the dissipation and formation of clouds. In clear humid air, dispersal of carbon black at the altitude of existing cumulus clouds resulted in cloud creation. This was thought to be due to thermal updrafts produced by solar heating, moisture being raised to an altitude where the temperature was low enough for condensation to start. On the other hand, clouds were dissipated by treating warm cumulus clouds with small amounts of carbon black. In these tests, it was assumed that absorption of solar radiation altered heat distribution in the cloud. These hypotheses were based on studies of the origin of tropical rain.

As evidence of the great amount of published material in the fields of space science and exploration, the Office of Technical Services, U.S. Department of Commerce announces a bibliography of unclassified information amounting to 278 pages and including 2274 separate references. The period covered is fifty five years, extending through the middle of 1958. A natural division is that of two categories, pre-satellite and satellite literature. The larger part of the bibliography has to do with the progress, development and uses of instrumented vehicles. This is largely because of the increase in published literature since the announcement of the International Geophysical Year. The compilation of this bibliography is the result of the work of the Naval Research Laboratory.

ANALYSIS AND STANDARDS

The Karl Fischer method of determining moisture in solids and liquids is subjected to the difficulty of interchange of moisture between the reaction cell and the atmosphere during titrations and introduction of samples. This difficulty has been overcome by Navy chemists by the development of a pressurized apparatus. It also provides stable storage conditions for reagents. The general utility of the apparatus has been demonstrated by constant use for a year on a wide variety of materials.

Urea occlusion compound formation, a method of separating molecules on the basis of size and shape, has been extended from the separation of hydrocarbon components of kerosene used for jet fuels to separation of different alkyl silanes. The length and cross-sectional diameter of the molecule are said to be limiting factors in urea occlusion. Scale models are used to predict which alkyl silanes will form urea occlusion compounds. This technique may also be applied in storing many compounds in which there is the highly reactive silicon-hydrogen bond.

New techniques have been developed by the Navy in radiochemical determinations by the use of polarographic methods. The requirements for the quantitative polarographic determination of an isotope is that it be polarographically reduced or oxidized to the zero oxidation state and amalgamated with the mercury. This technique indicates that the method has very large potential use to the chemist, not only enabling him to carry out quick and accurate analyses and separation of radionucleides, but also to learn more basic electrochemistry of dilute solutions and of electrode reactions. Many other applications in various fields of chemical research are also possible.

Uranium standards, developed by the National Bureau of Standards in cooperation with the Atomic Energy Commission, contain varying percentages of uranium-235, and the 234, 236, and 238 contents are also included in the official certificates. The different standards are available, of which five have 5% or less of the 235 isotope, while the highest has 93% of this isotope. A natural uranium chemical standard is also included in the series. The unit in each case is an amount of uranium oxide, U_3O_8, equivalent to one gram of uranium. Present certifications are provisional, but work is now being carried on to enable final certification.

HEAT AND POWER

A plasma arc torch that is said to develop temperatures up to 30,000°F is now being employed to make shapes and apply coatings of refractories, high-melting metals, and metallic alloys. A fundamental difference between this torch and the one usually used in welding is that the arc is struck between two electrodes in the torch rather than between one electrode and the work piece serving as an anode. A stream of gas moving at high speed between the ring-shaped space between the electrodes protects the torch

at the high temperatures of the plasma, and also carries molten material to the surface that is being coated. Feeds are either in the form of wire or of powdered material, the latter being introduced into the gas stream. Coatings of molybdenum, zirconium, titanium, and carbides have been applied to all types of materials, even to reinforced plastics. To obtain formed parts, coatings are applied to mandrels which can be dissolved later. In addition to coating operations, the high temperatures may be applied to such processes as the synthesis of acetylene, electric furnace operations, and supersonic wind-tunnel testing. In the last named application, the plasma may simulate speeds up to Mach 20.

In connection with researches sponsored by the Army in the field of ultra high temperatures, it has been proved possible to burn premixed ozone and combustible gases in pure ozone. Also pure ozone is converted to oxygen, and this is burned with such fuel gases as hydrogen, cyanogen, methane, carbon monoxide, and ethylene. Except for the last two, these gases can be mixed with ozone without detonation. Comparison of flames in which premixed ozone and oxygen are employed indicates that the ozone flames are characterized by substantially higher rates. In connection with this study it was found that data on a number of the physical properties of ozone in published literature were in error, and an evaluation of these properties as well as those of oxygen-ozone mixtures has been made.

A study of chemical reactions capable of yielding high temperatures has been made under the sponsorship of the Ordnance Corps, it being found that the most critical limiting quantity in flame temperature is bond energy. Diatomic species studies indicate that the N-N bond and the C-O bond are the two most energetic known. Variations in flame temperature are achieved through variation of pressures and volumes. The effectiveness of this control is related to the degree of dissociation of combustion gases.

Cheaper atom power may be realized with two new approaches. If mixed light and heavy water are employed as coolants in pressurized and boiling water reactors, control rods may be omitted, and the proportions of the two liquids may be varied to cut down excess reactivity. Starting with around 80% heavy water and a large amount of fissionable material in the reactor core, the effectiveness of this material is maintained by gradual dilution with ordinary water. The combination of control and coolant material is expected to reduce fuel costs to about one half that of an ordinary pressurized reactor, this being accomplished by extending core life.

A new hypersonic wind tunnel in which rarefied gas flow is studied employs extreme low temperatures in what is known as "cryopumping." The gas used, nitrogen in this case, is cooled to its solidification point, thereby producing a vacuum. In the pumping unit gaseous helium is circulated through coils in plate condensers at a temperature of 20°K. As pressure decreases, the pumping rate increases exponentially. The limiting pressure is that of those gases that do not condense at 20°K, but the amount of these in this process is very small. Pressures are reduced initially by ordinary pumps to around 1 mm, which permits cryopumping to 10^{-4}mm. A single cryopump will do the work of some 200 10 h.p. diffusion pumps necessary to accomplish the same result. Conditions in this wind tunnel are reported as being comparable to a speed of Mach 20 at an altitude of 300,000 feet. The tunnel will operate continuously as long as five hours, while the usual hypersonic tunnel functions for fractions of a second.

On the basis of the success of ammonium nitrate-fuel oil combinations in dry explosive operations, considerable interest is being felt in the utilization of ammonium nitrate in wet-blasting. Water is said to promote the explosive reaction, cooling gases and shifting equilibria in the desired direction. Another variation in the field of nitrate explosives is packing the nitrate in plastic or coating the nitrate particles in "wet" hole operations. Ammonium nitrate accounts for nearly one quarter of the civilian explosives market. Many of the operations of the same type are carried out in military engineering. Ammonium nitrate explosives are much cheaper than the dynamites and water-proof explosives, this being particularly true of ammonium nitrate-fuel oil mixtures. Considerable research is being carried on in the forming of metals by explosives as they are blown into dies, and also on surface-hardening by sheet explosives that have the same effect as hammering metals.

By utilizing several basic insulating components, a motor has been developed which has run for more than 100 hours while sealed inside an oven at 950°F, a temperature at which the motor glows in the dark. The bearings are placed outside the oven and are air-cooled. The motor has operated successfully for shorter periods at temperatures of 1200°F. The insulating components include glass cloth and large mica flakes bonded with phosphate; wire insulation in which the wire is covered with glass fiber and then is impregnated with a suspension of mica in phosphate solution; a liquid slurry of phosphate containing such reactive materials as Wollastonite, silica and other substances, which react after drying and pyrolyzing at temperatures above 600°F to develop the desired insulating properties.

Field tests of lead-acid storage batteries by a fixed-resistance method of high discharge has been found by the Army to be adequate and the least expensive of available testing methods. The constant-current method of discharge, carried out in the laboratory, gives a more accurate measure of the electrical qualities of such batteries. The purpose of the research was to evaluate the high rate discharge of lead-acid storage batteries using the fixed-resistance method of loading, and to compare these characteristics with those obtained by the constant-current method.

In order to develop alloy grids for storage batteries which represent a fair compromise between good growth characteristics and good corrosion characteristics, the Navy has come up with a quaternary alloy containing both tin and silver as well as the usual antimony, lead being the base metal for such grids. It was thought at one time that a ternary alloy of lead, calcium, and tin would be superior to the conventional lead-antimony alloy with 8% to 12% of the latter element. However, such alloy grids proved to have poor growth characteristics, although their corrosion properties were good. The quaternary alloy just described proved a satisfactory compromise.

A report of Air Force research in 1957 entitled Utilization of Energy Stored in the Upper Atmosphere has created a great deal of interest in connection with upper atmosphere missiles. A missile flying at an altitude of about 95 kilometers and at a speed of 400 meters per second would scoop up atmosphere, provide for the catalytic recombination of oxygen atoms into molecules, and permit the oxygen so produced to rush out of the tail of the missile to propel it forward. The most promising catalyst was found to be gold, and the materials of construction of the motor are alumina or mica. While the concentration of atomic oxygen at such heights is low, the energy developed by recombination would be sufficient to maintain the speed of the missile against the very low resistance of the highly rarefied atmosphere.

(Continued on page 22)

WEST WITH AN ARMY

(Continued from page 19)

as one of its managers. Rapid expansion strained the finances of the Reading and in 1839 Keating sailed for London to raise funds by the sale of stocks and bonds. There he died suddenly in May 1840. The London *Times*, unaware of the colorful career of the man who had passed away, missed the opportunity for a newsworthy item and carried only these few lines: "[Died] at his lodgings, in Albany-street, Regent's-park, on the 17th inst., William H. Keating, Esq., of Philadelphia, United States." It was not much to mark the death of a man who lived such a full life in a short span of forty years, but there is an eternal monument to Keating in the *Narrative of an Expedition to the Source of St. Peter's River* . . . This has grown more prized through the years, as an English reviewer forecast in 1825 when he wrote: "the information contained in these volumes will become a valuable record, as it appears to have been selected with much diligence, and a scrupulous attention to truth." The *Narrative* too, is a monument to the Army whose explorers blazed their way through the West when the United States was still in its infancy.

DEFENSE CHEMISTRY

(Continued from page 21)

MILITARY MATERIALS

Molybdenum has greater structural strength than steel at high temperatures, but is susceptible to oxidation. The National Bureau of Standards has developed a process of a two-layer, nickel-over-chromium plating that may make possible the utilization of molybdenum turbine blades and other components subjected to high temperatures. This work has been carried on for the Bureau of Aeronautics of the Navy. The coating is electrodeposited, and is said to prevent the oxidation of molybdenum for over 1,000 hours at 980°C, and for over 300 hours at 1100°C. The coating is both nonporous and ductile.

In addition to cermets, or metal-ceramic materials, ceramic compositions may be quite satisfactorily reinforced by metals, the ceramic being coated on the surface. Reinforced coatings average half the density of steel. Such reinforced coatings are applied as thermal insulation to aircraft and structural members operating at 2000°F to 3000°F. On the other hand, superalloys have been cast around ceramic rod reinforcements. Cermets are also electroplated with nickel and chromium to improve their impact resistance, and carbide grains have been chemically plated on titanium carbide grains. Both types of development have been carried out by the Air Force.

The feasibility of operating electronic equipment at 500°C has been investigated under the sponsorship of the Air Force, the study being directed to determining the essential properties of materials from which such equipment could be fabricated. Silicon irons and cobalt irons are said to retain most of their room-temperature magnetic properties at the higher temperatures. No lubricants, capacitors, or resistors commercially available were found capable of operating above 500°C.

Titanates of heavy metals such as barium titanate are of common application in electronic equipment. Potassium titanate in the form of fine fibers has appeared on the market as a high-temperature insulating material, which Chemical Engineering News suggests may have particular military applications. The fibers of potassium titanate are of the order of 1/25,000 inch in diameter, and have very low thermal conductivity because of high refractive index and ability to block infrared radiation by diffuse reflectance. In a test furnace equipped with new insulation, the heat-up time was about one sixth, the power consumption around one half, and the outside temperature two thirds that of a similar furnace with three times the thickness of firebrick insulation. The density of this material is a little over one third that of firebrick. Other possible uses include filter media, electrical insulation, plastic reinforcement, catalyst support, and even protective clothing.

Pure fused quartz filaments, while several times as expensive as the fibers commonly employed in reinforcing plastics, combine high temperature resistance, and high tensile strength at these temperatures, with the desirable properties of glass. The quartz filaments can be twisted into thread and made into cloth. This material has potential value as filters, flexible insulation, and reinforcement for plastics. Because of high strength at elevated temperatures, it may replace metal with reductions in weight of the order of 10 to 1.

Communications depend to a great extent on quartz, most of which is of the natural type imported from outside the United States. Large scale production of synthetic quartz by a hydrothermal process now appears possible on the basis of work reported at a recent meeting of the American Institute of Chemical Engineers. This conclusion is based on pilot plant operations in contrast to most of the previous work carried on in laboratory-size equipment. The yield of suitable finished filter plates from the stones made in the pilot plant is said to be substantially higher from synthetic quartz than from the natural product. This is largely due to the untwinned character and uniform quality of the synthetic stones, which are also nearly identical parallelopipeds, and which can be cut with minimum waste. Hydrothermal crystallization is described as "the use of an aqueous solvent under high temperature and pressure to increase the solubility of an ordinarily difficultly soluble material to a point where it can be crystallized on a seed crystal at an appreciable rate without excessive nucleation." Natural quartz crystals of sufficient size for communications use are found largely in Brazil, where they are mined by individuals rather than in large-scale operations. Depletion of the supply of larger stones is reported, and the availability of this material from South America has become unstable.

Hydrogen diluted with helium has been found by the Air Force to be the most satisfactory atmosphere in which alumina-base cermets could be fired. Specimens fired in such a mixture of helium and hydrogen proved to be compact and nonporous, and with properties equal to or better than iron metal alone. Solid solutions of aluminum and chromium oxides and alumina-nickel spinels were combined with iron. A pure hydrogen atmosphere was believed to produce too much reduction of the oxide phase, while helium alone or a vacuum permitted too little reduction. The oxide reduced by the hydrogen to the metal caused alloying with the metal and a better bond between remaining oxide and metal phases resulted.

Production of urethane foam by a one-step process has been announced by one chemical company, and others are expected to follow in the near future. In this process the components, a diisocyante isomer mixture, the catalyst system, and the polyol are all introduced together and mixed on the way to the mold. Rate of production is rapid, the mold conveyor going through a curing section, so that the total time is around 20 to 25 minutes. Further curing for fracturing closed cells, release of entrapped gases, and prevention of permanent set requires several hours, but does away with the crush-

ing operation. Urethane foams are standard cushioning materials.

Studies by the Navy of the rate of thermal polymerization of encapsulating resins were made at constant temperature by observation of the electrical resistivity of the material as polymerization continued. Agreement was observed between infrared absorption and volume resistivity, from which a measure of the degree of polymerization was obtained on the basis of qualitative agreement.

A new fluorocarbon elastomer, a copolymer of vinylidene fluoride and perfluoropropene, has been developed by industry under the sponsorship of the Quartermaster Corps. This material is peculiarly adapted to high-temperature service, and is said to show combined chemical resistance and thermal stability superior to some of the older fluorocarbon elastomers. Chemical resistance was determined by immersion in organic fluids at room temperature for 48 hours, after which the per cent volume swell was measured. Red fuming nitric acid is the medium for test of resistance to strong oxidizing agents. With both, the resistance of the new elastomer was shown to be quite high. High temperature characteristics were determined by exposure to air at temperatures from 400°F to 600°F, and to hot oils up to 500°F. The elastomer is primarily for use at elevated temperatures, and is not suitable for use below +10°F.

PROTECTION OF MATERIEL

Additives which increase the viscosity of water have been found to reduce the time required to put out a fire to as much as one tenth that ordinarily taken without such materials. Viscous solutions form much thicker films and hence do not evaporate as rapidly as water. Water-soluble cellulose derivatives are common materials of high molecular weight whose solutions have the necessary viscosity. Opacity of the extinguishing solution also adds to its effectiveness, this being accomplished by suspensions of talc and clay. Work in this field has been conducted under the sponsorship of the Bureau of Yards and Docks of the Navy. The materials producing opacity and a high degree of viscosity may be added as the water goes to the fire-fighting equipment, or treated water may be stored in advance.

A versatile overheat-fire detector that appears to offer many applications has passed from the field of airplane engines to practically any process in which a sudden rise in temperature indicates malfunctioning or danger. The detector consists of strips of refractory alloy in which are imbedded ceramic thermistor cores. The strips are assembled on the surfaces of equipment as needed, and a current of the order of 10 volts is applied. The resistance is high, but as the temperature rises, the resistance drops and, at a danger point, an alarm sounds. If the heating is temporary and the original conditions are again attained, the alarm is cut off. The temperature is monitored along the entire length of each strip to take care of localized heating. Normal alarm ranges are of the order of 200°F to 1000°F, but the strips can be adapted to very low temperatures, as low as −65°F. Changes in the system can provide for alarms in case temperatures fall as well as rise to an undesirable extent. This type of overheat detector should have numerous military applications to which thermocouples are not suited.

Sodium bicarbonate is a common fire extinguisher, being applied in dry form, the evolution of carbon dioxide being caused by heat. Potassium bicarbonate, however, has been shown by the Navy to have twice the fire-extinguishing efficiency of sodium bicarbonate. Tests were carried out on hydrocarbon fires of the spill-type. The efficiency appears to increase with the increasing atomic number of the alkali metal in the bicarbonate. When a powder cloud of bicarbonate was dispersed in the flame zone, a flareup occurred, which was caused by occluded air on the surface of the fine powder dispersing fuel vapor. Foam used along with the powder would reduce this disadvantage. Potassium bicarbonate powders have accordingly been recommended for service use, especially for fuel-spillage and aircraft-crash fires.

A new type of sprinkler head has improved fire protection involving hazards of flammable liquids in the hanger deck space of aircraft carriers, the device having been developed by the Naval Research Laboratory. The head is a combination foam and water nozzle which delivers a spray pattern of foam when supplied with a 6% foam solution. When foam is omitted, the sprinkler head performs as normal water equipment. Reflash is prevented by a long-lasting blanket of foam. Activation is automatic and requires no manpower.

Since many insects depend on a waxy coating to prevent loss of water by evaporation, a coated silica gel in the form of an aerosol has shown considerable promise as an insecticide by rendering the protective coating permeable to the water necessary to insect life. The material is nontoxic, is not rendered ineffective by the usual development of insect resistance, and is indefinitely effective because of its inert chemical nature. However, it must be applied where outside moisture, such as rain or dew can not neutralize its action. A further important consideration is the danger of silicosis to pest exterminators, which can only be averted by a thorough understanding of the necessity of protection with adequate respirators and careful handling of these desiccating materials.

(Continued on page 29)

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SEAPOWER

The importance of naval readiness for support of American policies abroad and need for continuing modernization of the Navy are stressed in address before the Society of Naval Architects and Marine Engineers, New York, N.Y., November 14, 1958,

By

ADMIRAL ARLEIGH A. BURKE

Chief of Naval Operations

IT IS A PRIVILEGE to be asked to address the Society of Naval Architects and Marine Engineers. I am especially happy to have this opportunity to reaffirm the importance of the close bonds which have long been maintained between your fine Society and the United States Navy.

The Navy, and the professions which your Society represents, have grown strong together in close association. Ours has been a relationship of mutual respect, of frank recognition of the problems we share, of combined and co-operative efforts in the solution of naval problems, and of free interchange of new ideas and concepts.

This is the spirit with which we must look to the future. Many of the present day advancements in naval technology and design have been achieved because of this close working relationship.

The Navy is particularly aware of the many contributions your Society has made to the development of American seapower. This is an association we hope to continue and strengthen, for in keeping pace with rapidly advancing science and technology, we must redouble our efforts to exploit the full advantages of the sea in defense of our wonderful country.

World events of the past year give new impetus to our work. Twice this year, in rapid succession, the United States has been requested to support its friends with military strength against aggression. Twice we have responded, in Lebanon, and again in the Taiwan Straits.

Importance of a Ready Navy

In both instances American seapower was a key to successful support of beleaguered friends. In both cases, the United States was able to respond quickly and effectively to a call for help because of the readiness of our naval forces, the SIXTH FLEET in the Mediterranean, and the SEVENTH FLEET in the Western Pacific.

In the Lebanese crisis, the first elements of the United States Marines went ashore at Beirut just seven hours after the Navy received the order to go. American reaction in support of a friendly country was rapid, forceful and decisive.

This was possible because the SIXTH FLEET was deployed and ready.

In the Taiwan Straits another friend and ally was brought under attack. The free Chinese on the offshore islands needed American escort assistance to insure the unbroken flow of sustaining supplies from Taiwan. Again American reaction was prompt and effective in support of a friend and staunch ally.

Seapower as represented by the SEVENTH FLEET in the Western Pacific was again an important part of the answer.

These events are practical examples of American seapower in action in the Twentieth Century. It is becoming more generally recognized that modern naval forces are important because of what is actually happening in the world.

What has been happening will continue to happen as long as the Communists cling to their ambitions to rule the world. Wherever they attack the free world the U.S. Navy will have to be ready. The Navy will in the future as in the past have to be there on the spot to act immediately in support of American policy.

Versatility of Naval Forces Essential

We are dealing with many areas of the world where many of the things we need to handle a military situation have to be brought in by sea, including air cover, combat troops and sustaining support. This means naval forces. It means naval forces capable of performing a wide range of combat functions, from amphibious assault to the full force of air attack.

American seapower is a basic element of free world strength.

ADMIRAL BURKE

Admiral Burke was born in Boulder, Colorado, October 19, 1901. He was graduated from the U. S. Naval Academy in 1923. His distinguished naval career, especially his service during World War II, is well known. However, with the Navy in the role of "host service" for the 1959 annual meeting of the A.F.C.A., it is of particular interest to note some of the numerous honors which have been awarded Admiral Burke. His decorations include, in addition to the Navy Cross, the Distinguished Service Medal with Gold Star, the Legion of Merit with two Gold Stars and Oak Leaf Cluster (Army), the Silver Star Medal, the Commendation Ribbon, the Purple Heart Medal (for wounds received while serving on board the USS CONWAY during July 1943), the Presidential Unit Citation Ribbon with three stars, the Navy Unit Commendation Ribbon; American Defense Service Medal, Fleet Clasp; the Asiatic-Pacific Campaign Medal with two silver stars and two bronze stars (twelve engagements); the American Campaign Medal; World War II Victory Medal; Navy Occupation Service Medal, Europe Clasp; the National Defense Service Medal; and the Philippine Liberation Ribbon. He has also been awarded the Ul Chi Medal and the Presidential Unit Citation from the Republic of Korea.

When we speak of seapower, however, our vision includes more than naval forces. It includes the Merchant Marine and the full range of commercial shipping as well.

But seapower is even more than this. It is the sum total of weapons, ships, shipbuilding capacity, natural geography and the technical and design skills of our naval architects and marine engineers. It includes all those things which enable a nation to use the sea advantageously during peace or war.

These, of course, are the physical things, the tools of seapower. They can be made effective only by a nation whose people are aware of the advantages offered by the sea and who understand how to use their maritime assets in their national interests.

These are primary American assets but recognition of these fundamentals must be linked to the practical dynamics of a rapidly changing world.

Science is constantly opening new frontiers in weapons technology. New developments are continuing to help make the Navy stronger and better able to exploit the advantages of the sea.

The Navy remains ever alert to new things, readily receptive to new ideas and flexible in adapting new developments for use at sea.

This is characteristic of a forward-looking organization, a dynamic service that for more than a century has provided imaginative leadership in many fields of American science and engineering.

Teamwork in Nuclear Power Progress

The history of naval achievements in nuclear power is a classic illustration of the pioneering spirit of the Navy and the benefits of teamwork between science, engineering, industry and the Navy.

In 1939, shortly after they had demonstrated that energy was released by uranium fission, Professor Fermi and Dean Pegram of Columbia University suggested its possible use to the Navy for propulsion power.

Naval authorities immediately saw the possibilities and the Naval Research Laboratory was promptly granted funds to start preliminary work in this field.

By July, 1940, the Naval Research Laboratory had organized a nuclear program and developed an isotope separation method.

However, in 1942, when the Manhattan Project was established the Laboratory's work was diverted toward the urgent work of atomic bomb development. During this time it was determined that nuclear power for special purposes could probably be developed in about ten years.

In 1946 certain naval officers, among them Captain Rickover,* were selected to go to Oak Ridge for study and training in the nuclear field. Also during this period the Naval Research Laboratory evolved a concept of a submarine propulsion system based on its work prior to 1942.

In 1948 the Atomic Energy Commission was reorganized to provide for nuclear reactor work. When this happened the Navy was ready, and contributed the framework of its nuclear power program to the joint AEC-Navy organization headed by Captain Rickover. This organization provided the coordination between the Navy, the Atomic Energy Commission and industry which resulted in rapid development of the program thereafter.

The success of this program required team effort on the part of many men in science, industry and the Navy.

It has been this energetic teamwork, together with dynamic leadership and plain hard work by a lot of people, that has enabled the American nuclear-powered submarines, NAUTILUS, SEAWOLF and SKATE to capture the imagination of the entire world with their exploits.

It has been in this pioneering spirit that the United States has led the world in applying nuclear propulsion to ships. We are getting nuclear power in surface ships too. The USS ENTERPRISE, a nuclear-powered aircraft carrier, is now under construction, as is the USS LONG BEACH, a nuclear-powered cruiser. A contract has also been awarded for construction of a nuclear-power guided missile frigate.

In a similar manner the Navy has accomplished much in missiles, all kinds of missiles, and aircraft, and anti-submarine warfare, and electronics, and, in fact, in many fields.

Modernization Is Continuing Process

Modernization and improvement of naval forces is a continuing process. The tasks of the Navy place heavier demands upon our ships, our aircraft, and our men in support of American policies abroad.

We need quality in our ships and in our equipments. We are getting this as a result of a lot of hard work. Individually our new ships are good, but unfortunately we have many old ones. To maintain their usefulness in keeping with advancing weapons technology, it takes constant fleet modernization and an adequate annual replacement of aging ships and aircraft. Eighty percent of our ships saw service in World War II. The average life of a ship is around twenty years.

Our new destroyers and aircraft are four times as good, four times as powerful as their World War II counterparts. But we still need numbers of ships as well as quality in each ship.

Naval forces are deployed and operating every day throughout the year, in many parts of the world.

To meet its world-wide commitments the United States must have ships in a number of different places at the same time, in the Mediterranean, in the Persian Gulf, in the Atlantic, in the Pacific and in the Western Pacific areas.

Our ships also participate in support of Atomic Energy Commission tests, in the International Geophysical Year program in the Antarctic and in the rescue and relief missions at sea all over the world.

In addition to numbers of ships, and quality in each ship, we need reliability. We cannot afford to have ships off the line because of material failure or breakdown. Our equipment must be rugged and reliable. It must be able to stand rigorous and continuous operation.

On top of all this is the constant need to conserve dollars, to do things not only better but also much more economically.

Seek Ways to Offset Rising Costs

To maintain a proper modernization and replacement program costs money. Today costs of new ships, aircraft and weapons are rising rapidly. The costs of an F4U Corsair, the Navy's best fighter, in 1944 was $120,000 including spares. The Navy's top performing fighter today costs $1,600,000 including spares, just fourteen times as costly as its earlier counterpart.

The increased cost of ships is no less startling. From $9 million for a destroyer in World War II, our guided missile destroyers under construction today will average about $35 million. The nuclear powered frigate is costing over $100 million.

Part of the Navy's answer to the problem of costs has been to develop weapons systems with multiple capabilities. Each one of our ships can do a number of

*Has since been promoted to Vice-Admiral.—ed.

different things. They are deployed to achieve strategic objectives, they perform tactical missions, they conduct offensive operations, defensive operations and support functions.

The result has been great versatility in our forces, great flexibility in their employment and in general greater economy.

In this connection the emphasis which this annual meeting has placed upon value engineering is very encouraging. It is important in these days of rapidly rising prices that we do everything possible, to cut costs, to spend our dollars wisely and to get as much as possible for each dollar spent.

One of the greatest problems which confronts the military chiefs now is how to achieve the proper balance between immediate readiness and future capability. These rising costs present us with some very difficult problems.

Sees Continuing Communist Aggression

We know we are going to be faced with the same type of Communist aggression we have had in the past. Year after year, month by month, the United States will be confronted with attacks by the Communists on free nations of the world just as we have in the past several years.

We must be ready to meet these attacks just as we have in the past. The Navy must be ready to act at any time at any place in the world. This means we must maintain our immediate readiness.

At the same time we must be ready for all-out nuclear war, unlikely though that may be. General nuclear war will remain unlikely though just as long as we are ready to fight it.

Russia knows that we can strike her from many different directions by many different means, so it is unlikely that she will start a war which means her own destruction.

One of the very best systems of nuclear retaliation is the POLARIS submarine. It has many good qualities. It will be hidden at sea. It will be constantly moving. No surprise attack can destroy or nullify POLARIS submarines at sea. The enemy won't know where they are, but the enemy will know they are ready and capable.

It is a comparatively cheap retaliatory system. It won't be necessary to maintain large residual forces of POLARIS submarines against the possible destruction of surprise attack.

It won't take very many to destroy the enemy if there should be another war. This is one good way the Navy can equate the rising cost of weapons of war against the actual requirements to do the job. It is a vital part of our overall retaliatory power.

Although this weapons system is basically a one-purpose system, it is inherent in any ship to have other potential capabilities as well, such as reconnaissance, monitoring, barrier patrolling and other seagoing functions.

This means that we have the ultimate prospects of getting even more for our money.

It is clear that if American military power is to remain strong, we must be alert. We must remain receptive to new ideas. We must continue to welcome modern methods in science, in technology, in design, in engineering, in manufacture, and in cutting costs across the board.

Use of the Sea to Strengthen Defenses

We must use the sea in every way we can to strengthen our defenses, to take advantage of the vast space that it offers, and to benefit from the economies inherent in seagoing capabilities.

Our ability to keep the oceans free, however, is being challenged by a powerful and determined enemy. As we turn our minds and our hands to the tasks ahead of us, we must recognize that we are in the most serious competition we have ever faced in the life of our nation.

Like any worthwhile human endeavor, it takes hard work to succeed in the face of all-out competition. It is up to us, to you and me, to set the new pace of effort, to set new records of achievement, to establish new standards of perfomance in everything we do, in the military, in science, in education, at sea, in business, and in our engineering and technical skills.

We must reaffirm our belief in the future of our country and rededicate ourselves to the principles which placed us in a position of leadership in the world. For our position is being challenged.

Only by meeting his challenge boldly, with courage, with vigor, and with the will to win today, tomorrow, and always, can we have any hope of furthering the great enterprises of the free spirit.

CHEMICAL INDUSTRY ACTIVE IN FIGHT AGAINST AIR POLLUTION

National Conference in Washington is addressed by General John E. Hull, president of Manufacturing Chemists' Association

WASHINGTON—A quarter billion dollar annual expenditure for the control and avoidance of air pollution by the nation's chemical companies alone was cited here recently as only one of the many contributions of the industry in this area of public concern by General John E. Hull, USA (Ret.), president of the Manufacturing Chemists' Association.

General Hull reported the figure in addressing the National Conference on Air Pollution called by Dr. Leroy E. Burney, Surgeon General, Public Health Service, U.S. Department of Health, Education and Welfare, on November 18-20, 1958.

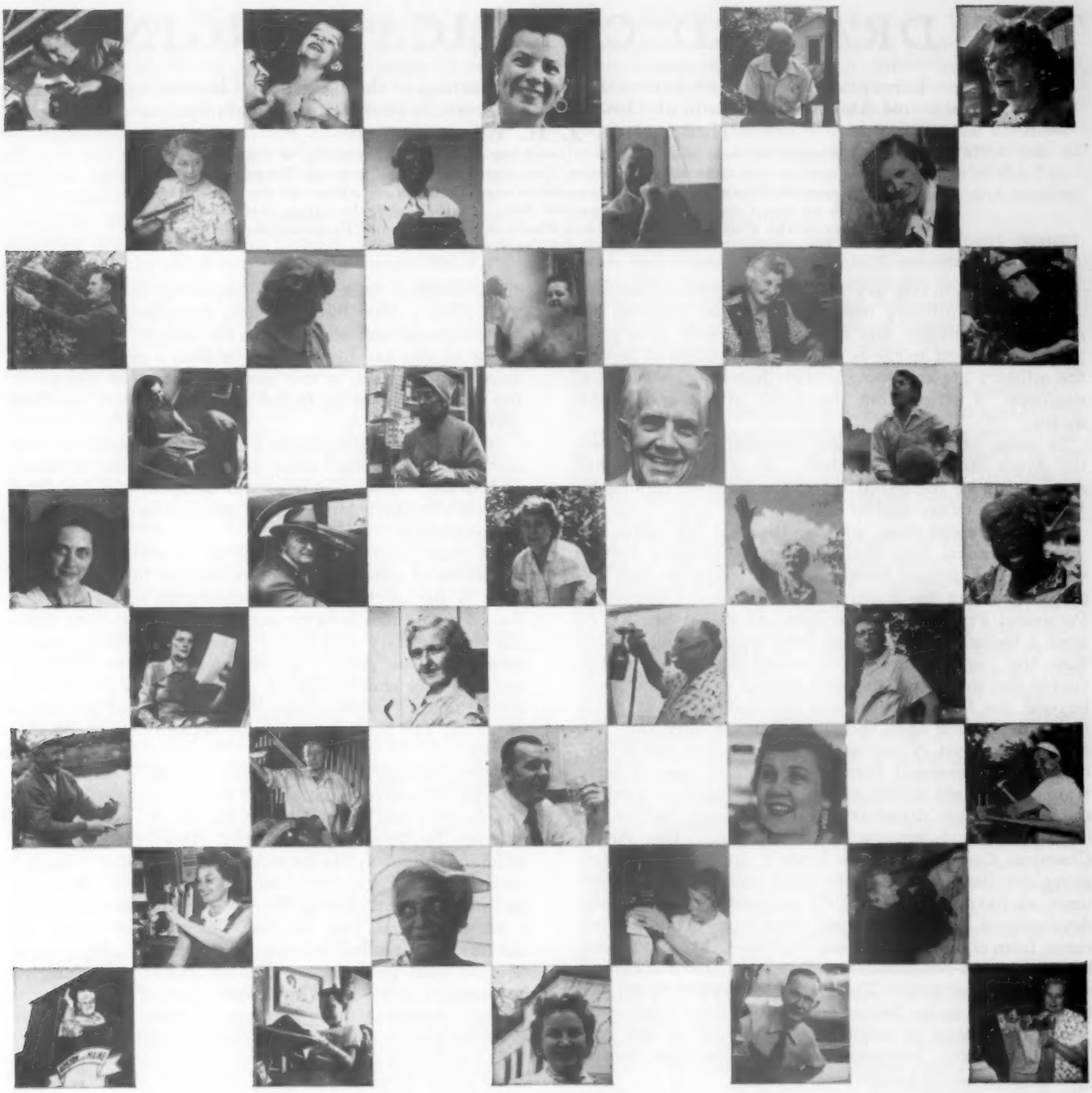
In addition to citing the past accomplishments of the chemical industry on this problem, General Hull also called for proper consideration of a wide variety of complex problems when necessary public controls are being studied.

These problems include, "A technology which is still far from complete; geographical units which may ignore political boundaries, and many of which have problems peculiar to themselves; the great number of sources and kinds of air pollutants, many of which are not caused by man; the income sources of a community and industrial employees; and even the vagaries of the weather."

General Hull attributed much of the industry's advanced position in the field to economic as well as broad scientific understanding of the entire problem. He pointed to the high cost of control equipment and processes and added that the "costs of goodwill, public relations, plant location, and compliance with regulations come high for the chemical industry, and therefore, it is good business for the chemical producer to avoid air pollution as much as possible."

General Hull said that honest public understanding is essential to solving these problems and is the responsibility of scientists, industry, the press, or any others communicating on pollution.

The three-day conference included more than seventy speeches covering all aspects of the problem. It is understood a comprehensive report on this meeting will be prepared by the Public Health Service.



alive today! ... *like 400,000 other Americans cured of cancer who went to their doctors in time*

Let's give our doctors a chance. Thousands of Americans are being cured of cancer every year. But too many are losing their lives needlessly because they failed to consult their doctors when the disease was in its early . . . and therefore more curable . . . stage.

Form the life-saving habit of a head-to-toe physical checkup once a year. For men, this should include a chest x-ray; for women, a pelvic examination. Make it a habit . . . for *life.*

American Cancer Society

THE DRAFTED CHEMICAL ENGINEER

Excerpts from a speech before the annual meeting of the Baltimore Chapter of American Institute of Chemical Engineers, September 16, 1957, by

BRIG. GEN. J. H. ROTHSCHILD

(General Rothschild, now retired, who is teaching chemical engineering at University of Colorado, was, at the time of retirement, Commander, Army Chemical Corps Research and Development Command. He had extensive experience as an officer of the Chemical Corps, both on troop and technical command duty. It is believed, therefore, that his views with respect to the Enlisted Scientific and Professional Personnel Program should be of particular interest.)

I WOULD LIKE to talk to you today on the transition from civilian to military life for the drafted chemical engineer. Incidentally, this subject, in reverse, is of great personal interest to me as I am in the process of leaving the military life and going into civilian life as a chemical engineer. I retire from the Army at the end of this month.

In some cases, the drafted chemical engineer enters the Army directly from school. In others, he has had some years of industrial experience before coming in. What I have to say applies to both.

At the present time, and for the past ten years, the young technical man drafted into the military service who has the proper background of education and experience enters the Enlisted Scientific and Professional Personnel Program. These men are called SPP's. At least a bachelor's degree has been required but beyond that, the requirements have varied depending on the supply and the needs. At times several years' experience beyond the basic degree was necessary, and at other times, depending upon the particular specialty, only the BS was required. A man selected for the Enlisted Scientific and Professional Personnel Program goes to basic training for eight weeks, and is then assigned to a job in the Army which draws on some significant part of his educational and experience background. The Army Chemical Corps has drawn heavily upon this talented group and has been one of the chief users. At the present time, we have over 1,000 SPP's engaged in research and development, procurement and other types of work. They range from chemists, chemical engineers, thru physicists, bacteriologists, statisticians and so on. I have observed many of these men. Their degrees varied from the Baccalaureate to the Doctor's; their industrial experience varied from none to several years. They all had one thing in common, however, they were the ones chosen by their local draft boards.

Right here is where we begin to separate the sheep from the goats, and it comes down to a matter of attitudes. The man who comes into the Army feeling that he has been badly imposed upon, and is about to waste two years of his life, probably will mostly waste those years, but he would be wasting much of his life anywhere.

In the first place, service to one's country is an obligation of every citizen, and in a country like ours, it's a privilege. The fact that one man is selected and another is not does not alter this fact. In the second place, no experience is wasted. The sum total of what a man is, is a summation of his experience and his innate ability, and the Army has a great deal to offer to expand a man's experience and develop his capabilities.

The main thing for this young technical man to keep in mind is that the same personal attributes which will gain him recognition in military life are necessary in civilian life.

What I'm about to say might sound like a talk on training personnel, as I am going to talk about a few of these abilities which are so important in any line of work, but a little thought along these lines might help the technical man coming into the Army. Though only a few of you are likely to be drafted, a number of you have sons who are in this category and *all* of you are in the position of being called upon for advice by these men.

It's difficult to place them in order, but let me start by saying that our man must have *imagination, initiative* and *drive*. Imagination to see what should be done, initiative to start doing it, and drive to carry it through to completion.

He must have the *ability to work with people*. As the forms of showing respect as adopted by the military, such as the salute, seem to bother some of these young men, I would like to bring out the fact that in both civilian and military life, older, more experienced people who have been given a greater degree of responsibility are normally shown respect. This does not call for any appearance of subservience, but the form of politeness as called for in that particular society should be observed.

These abilities include a strong feeling of *responsibility*. An individual must accept the job assigned to him and carry it out to the best of his ability, regardless of whether he likes the job or not. One of the greatest failings I found in the technical officers, many commissioned directly from civilian life, working in research and development during World War II was that given a job they liked, they did fine, but given one they did not like, they tended to lie down on the job. Any young tehnical man going into a civilian industry is going to be assigned many jobs he doesn't like. He must have the *self-discipline* to do his best on these tasks as well as on the pleasant ones. This constitutes *dependability*.

The technical man must learn to think directly to the *heart of the problem* assigned to him, to determine the essentials, usually few in number, of the problem. He must determine clearly and specifically what objectives he is trying to reach, and not deal in generalities. This cannot be stressed too strongly and probably constitutes the rarest and most precious ability. Thinking in generalities leads generally in the right direction, but the rate of progress is slow. Thinking in specifics will lead one down the most direct path to the goal.

The technical man must be able to *present his subject clearly* and convincingly both orally and in writing. In so doing, he must determine clearly what audience he is striving to reach, and specifically what points he is trying to put over. He cannot talk or write in generalities as he will cover too much territory, and will not have the punch necessary to achieve his objective.

What I have said here applies to the purely military side as well as to the technical side of the service in the Army. Incidentally, it is on this side that the man can probably learn the highest degree of self-discipline. Nobody likes K.P.

Now let's look at the types of work upon which we

put our SPP's in the Army Chemical Corps. The chemical engineer assigned to the Chemical Corps is very fortunate. Not only have we had the reputation of using these men effectively and giving them heavy responsibility commensurate with their abilities, but *they* have a fine opportunity to contribute in a field of great importance to the Country, though much too little is known generally of the potentialities of the weapons developed by the Chemical Corps. . . .

A large portion of our process development work and pilot plant operation is handled by SPP chemical engineers. They assist in working out the process in the laboratory, designing a pilot plant to check the process and then act as shift operators and foremen in operating the plant. This includes both chemical and biological plants.

Our SPP chemical engineers are engaged in research on weapons—better methods of projecting flame, of generating smokes, of disseminating toxic materials. They work in the development field on weapons, designing prototypes of munitions. In the protective field, they assist in the development of components of protective masks and in the design of automatic alarms to warn of the approach of chemical or biological agents.

These are just a few examples of the types of work our SPP chemical engineers are placed on. The amount of responsibility assigned to the individual engineer depends upon his ability. . .

(The speaker here quoted from two letters—one from a company and the other from an SPP, testifying to the value of the program—and continued)—

And so, the drafted chemical engineer with the proper attitude, and most of them have this, who is leaving the Chemical Corps is a better man than when he came in. He has broadened his experience greatly by having had contact with all sorts of men in a different atmosphere than he has been accustomed to. He has learned great self-discipline and is more mature. He probably has been physically strengthened. He has gained a valuable technical experience. He has had the opportunity of making a concrete contribution to his Country.

DEFENSE CHEMISTRY

(Continued from page 23)

Some of the newer fungicides based on fluorinated aromatic derivatives present analytical difficulties, which have been largely overcome in Air Force laboratories by extraction with methanol from the cloth to which they have been applied, followed by ultraviolet spectrophotometric measurements. Other compounds present in the cloth did not interfere with the determination. The method is said to be applicable to biphenyl fungicides. Determination of similar fluorinated fungicides made from aromatic hydrocarbons was based on the interaction between the fungicide and the treated material, the methods involving polarography, spectrophotometery, and colorimetry. Direct ultraviolet spectrophotometry was found to be equally as sensitive as polarography and more rapid in fungicides containing both fluorine and sulfur. In the case of leather, it was found necessary to separate the fungicide from the tannins and other interfering substances.

Recent researches by the Quartermaster Corps have confirmed the conclusion that deterioration of heavy cotton fabrics is primarily due to photo-oxidative changes rather than heat-induced hydrolytic breakdown of compounds from which dyes were made, although this factor may be of some importance. Both dyes and fungicides applied to cloth contain the seeds of destruction of the material they are expected to protect. This is true of anthraquinone vat dyes and also of such fungicides as copper naphthenate and halogen -substituted compounds such as certain dihydroxy-dichlorodiphenyl methanes. The experimental work recently reported was carried on with cotton duck treated with anthraquinone 2,6-disulfonic acid, and it was shown that deterioration was at rates directly related to the light intensities of the Panama jungle shade, New Orleans open field, and tropical chamber exposure sites.

Protection of delicate electronic equipment against shock and vibration is a constant problem of the Air Force. This department announces the development of an effective cushioning material composed of very thin Teflon rods imbedded in a matrix of silicone rubber. This medium is readily formed into slabs. The high internal damping is thought to be the result of friction at the Teflon-rubber interfaces. Maximum transmissibility proved to be considerably smaller than that specified in current military requirements for vibration mounts and much less than that used in the aircraft industry for the protection of critical equipment items. Materials made up of this cushioning material withstood temperatures from −85°F to 482°F.

The Quartermaster Corps has come up with a thorough review of the basic concepts of the energy dissipation in airdrop of cushioning materials. This report contains the following general conclusions. There are certain basic factors in aerial delivery that depend on the drop conditions. These factors are adequately described by the fundamental equations of motion and energy. The energy dissipation characteristics required of a cushioning material can be calculated from the drop conditions by application of these equations. Analysis shows that the amount of energy dissipated per unit volume, the stress-strain relationship, the bottoming point, and the resilience are important factors in the proper evaluation of cushioning materials in aerial delivery. Stress is shown to be a better method of expressing fragility factors than gravities. It is shown that the energy dissipation of a foamed plastic is a function of the chemical composition of the plastic, and varies directly with the square of the density of the foam. It is probably independent of the size of the foam bubbles.

PROTECTION OF PERSONNEL

The greatly increased resistance of *staphylococcus aureus* (commonly known as "staph") to antibiotics has required greater use of antiseptics in hospitals to get rid of bacteria of this type. The standard disinfectants of proven value against this organism are the synthetic phenols such as ortho-phenyl phenol and ortho-benzyl para-chlorophenol, iodine and

Palladium Ammonium Chloride, Palladium Black
Diammine [illegible] Palladium [illegible] ide Diam
oxime, [illegible] Monosu
Palladium Oxide, [illegible] Palladous
Aldehyde, Palmitoleic Acid, Palmitoyl Chlori
[illegible] Papain, Pectin, Penthenol, Pant
[illegible] Pectinolytic Enzymes, Pellidol, [illegible]
Pentaacetyl-d-glucononitrile, [illegible]
[illegible] Pentaerythritol [illegible]

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its compounds (mixed with nonionic surfactants), and quaternary ammonium compounds, the last named, however, being ineffective against some Gram-negative bacteria. Some newer disinfectants include one that can be used in the final laundry rinse and is not a soap, and another which is a nontoxic colloidal silver compound. Several new antibiotics are also promising in their staph-killing power.

The Navy has developed and evaluated a neoprene-coated nylon twill that appears superior to other coated nylon fabrics for use in clothing for cold, wet weather. Tear strength proved to be two or three times that of any other equivalent weight fabric tested, and the new material dyed and coated easily. Performance under actual outdoor exposure conditions showed improved durability. The low-count, or coarser, filament fabric is more easily produced and at less cost than the fabrics using finer yarns, these low-count filaments being more readily available in times of critical supply.

The impact of ballistic missiles in multilayer nylon body armor has been investigated microscopically by the Quartermaster Corps. A panel of twelve identical layers of 2 x 2 basket weave nylon fabric weighs fourteen ounces per square yard. A fragment simulator 0.22 caliber steel missile was fired with a striking velocity of 1100 to 1400 feet per second. Cross sections were observed at various levels and directions. The panel was also separated into individual layers to show the stoppage of the projectile. Some heat damage was observed, and fibrillation indicated the vigorous movements of filaments. Cross yarns were shown to have restricted permanent deformations to small regions, thus preventing propagation of stress for any considerable distance.

Some 600 high schools throughout the nation are to instruct upwards of one million students in radiological defense by the use of instrument kits distributed by the Office of Civil and Defense Mobilization. The instruments will serve to acquaint students with the general principles underlying radiation, and will function as training aids for instruction in survival in the event of nuclear attack. Each kit contains nine instruments, two comparison standard sources for food and water, and a manual of instructions. The instruments include those measuring the rate of radiation and those which tell the total radiation accumulated, and are used in measuring the intensity of radioactive fallout.

Recent research by the Navy indicates that, contrary to the general assumption that the long-term radiological hazards due to fallout from a nuclear detonation depend primarily upon the long-lived fission products, a very important factor is the presence of other radioactive products that are not derived from fission reactions. These latter products would be created by neutron activation of elements in the immediate vicinity of the detonation. The presence of one such product, cobalt-60, has been indicated by analyses of fallout material and of biological specimens recovered from fallout areas.

FOODS

An extensive investigation of odors from cooked food conducted by the Quartermaster Corps indicates that substances commonly described as disagreeable, when present in trace amounts, may contribute to an acceptable flavor. Recent researches indicate that the volatile component of cooked cabbage is derived from a methylcysteine sulfoxide, a free amino acid occurring in cabbage, and the odor is due to a large extent to dimethyl sulfide. Its formation and evolution are slow processes, and when cabbage is properly cooked and for a reasonable time, the volatile sulfur compounds contribute to an agreeable flavor.

Sterilization of foods by heat has been practiced for centuries. Thermal processes, however, lower to some extent of palatability and nutritive qualities of foods. The quantity of ionizing radiations needed to sterilize canned foods has also somewhat the same effects. Heat processing schedules are based on the minimum levels required to kill microorganisms endangering health or causing spoilage. A combination of heat and gamma radiation is more effective than either alone, being synergistic in their action. A series of studies sponsored by the Quartermaster Corps of the Army has shown in experiments with canned meat that the amounts of heat and irradiation energy together were less than when either form was used alone. A definite amount of gamma radiation was required before heat-processing treatment could be appreciably reduced and still produce sterile meat. The number of spores of the microorganism determined the quantity of heat required when the standard minimum of irradiation was employed.

INSTRUMENTATION

A leak detector depending on thermal conductivity is said to have several advantages over a mass spectrometer. The probe gas is either hydrogen or helium, and the equipment may be used with both pressure and vacuum systems. It is said to be especially effective in locating Freon leaks even when there are appreciable quantities of the refrigerant in the air, and is particularly adapted to detecting such leaks in poorly ventilated spaces. This equipment was developed in the Naval Research Laboratory.

There are many instruments that automatically determine a single quantity in a material, repeating these tests on samples and recording results. Some instruments not only record quantities but control valves and proportioning equipment. It has remained for a large laboratory equipment manufacturer in Great Britain to exhibit in the United States, at the recent National Chemical Exposition in Chicago, apparatus that will perform automatically analyses that require as many as twenty different steps. A typical instrument that was exhibited, in fifteen steps, takes a measured amount of liquid to be analyzed, adds all necessary reagents, then waits until reactions are complete. Next comes titrating with an analytical reagent. The buret reading is read photometrically, after which the result is recorded. Finally the vessel is emptied and washed, the buret refilled, and an alarm is given if there is a deviation from specifications. By operating on a 24 hour basis, three skilled analysts are replaced at a saving of $20,000 a year. Each type of instrument is made to order, ranging from those that are relatively simple to those that are extremely complicated. So far the equipment is limited to liquids alone, some apparatus, however, being designed for filtering samples and reagents.

DETERIORATION

(Continued from page 16)

Because of the changing tenor of the times, the climatic factors which have been included by the Center as deteriorative agencies call for revision and expansion. The so-called space age is now imposing requirements for information, of a type similar to that provided by the PDC in the natural climatic factors, for such environments as shock and vibration, acceleration, aerodynamic heating, great extremes of temperature, high altitudes and low pressures, dissociated gases, meteoritic dust, aurorae, and many other related and deteriorative factors for the materials and equipment of the present and the future.

OCDM PLAN FOR IMPROVISED FALLOUT SHELTER

THE Office of Civil and Defense Mobilization has announced plans and descriptive information for a low-cost shelter against radioactive fallout, suitable for most home basements.

The semi-improvised shelter is suggested, using sand-filled or earth-filled bags piled up around a wooden frame, for a typical basement corner. An L-shaped doorway is recommended, with a wooden door to the shelter area.

Distribution of the plans and building information began with a suggestion by OCDM Director Leo A. Hoegh on a nationwide television program "that families would be interested in ideas for improvised low-cost fallout shelter." In line with the new Federal shelter policy for the nation, OCDM recently released a technical bulletin describing permanent fallout shelters for construction in basements, in backyards, and under garages, etc.

Thousands of requests for shelter plans and information have been received by OCDM.

The information being supplied with the plans for low-cost shelter explains fallout — the windborne spread of radioactive debris from nuclear bomb explosions — and its dangerous radiation. OCDM notes "there are many things individuals can do now for protection of themselves and their families."

The information points out that fallout shelter is a shield against radiation. The thicker and heavier the shield, the better protection.

Besides sand or earth, OCDM lists other materials that might be used around the basement shelter — such as building bricks, solid concrete blocks, books, magazines, newspapers, water in containers, and lumber. Weights per cubic foot of material are given, with the warning that if overhead shielding is put on the floor above and a strong shell is not constructed, the floor beams must be propped from below to support the additional weight.

"If you cannot set up a basement home shelter," says OCDM, "the next best solution would be to take shelter in a room with the fewest 'weak points' (windows, outside doors, etc.) or an inside hallway." All home windows and outside doors should be closed against infiltration of fallout particles.

OCDM notes that improvisation of a shelter area could continue after nuclear attack, because fallout — carried by the winds — may not in some cases, reach your area for an hour or more.

The information material concludes with directions for stocking the family fallout shelter. Key items recommended are emergency food and water, a battery-operated radio, flashlights, bedding, first-aid kit, and sanitation aids.

NOTE: THESE DIMENSIONS MAY BE VARIED TO SUIT.
MIN. FLOOR AREA - 10 SQ. FT. PER PERSON.
MIN. VOLUME - 65 CU. FT. PER PERSON.
SWING DOOR INWARD
2'-0" MAX.
DIMENSION VARIES (SEE NOTE)
DIMENSION VARIES (SEE NOTE)

TEMPORARY BASEMENT FALLOUT SHELTER

AUSA MEETING ACCENTS MISSILES

The 4th Annual Meeting of the Association of the U.S. Army, accenting the role of the Army in the field of guided missiles, was held at the Sheraton-Park Hotel, Washington, D.C., on October 20, 21 and 22.

The registration for the meeting, one of the largest yet held, was reported as 2700, many of the numerous sessions filling the large auditorium and banquet hall of the Hotel. The meeting brought military delegates, including both officers and enlisted men, from chapters throughout the country, as well as many civilian members, including representatives of science and industry. The program, which had been arranged by the permanent management staff of the Association, now headed by Lieutenant General Walter L. Weible, USA Retired as Executive Vice President, covered a wide field of Army interests.

General Maxwell Taylor, Chief of Staff of the Army, was out of the country at the time and the lead-off speech was made by the Army's Vice-Chief of Staff, General Lyman L. Lemnitzer.

Speaking on future requirements, General Lemnitzer stated that any reduction of the Army's need for personnel through the improvement of weapons will depend upon the extent to which these weapons will "be capable of producing an aggregate of military effectiveness equal to the requirements of the threat."

The program on the first day featured addresses on the role of NATO and SEATO, respectively, by Admiral Antoine M. L. Sala, French Navy, Naval Deputy to the Supreme Allied Commander, Europe, and His Royal Highness, Prince Wan Waithayakon, Minister of Foreign Affairs of Thailand.

The morning session of the second day brought a panel discussion led by Mr. Roger Hilsman, of the Library of Congress, on the philosophic and political aspects of today's military situation, under the title "The Application of Military Force in Support of Free World Policy."

Of much interest was the luncheon address on current military "facts of life" by General Nathan F. Twining, Chairman, Joint Chiefs of Staff. In forthright manner, General Twining, long an Army officer himself before the inauguration of the separate Air Force, stated some reduction in service personnel could be expected in the balancing of the various factors of our national strength, including economic and political as well as military.

In respect to the Army's emphasis on its need for expanded airlift capabilities, General Twining observed that more important considerations of today necessitate according airlift a lower degree of priority. These two subjects were prominent among the resolutions adopted by the Association at its subsequent Business Meeting—one calling for an active Army of not less than one million men, and the other, declaring capability for prompt action by the Army's Strategic Army Corps is inhibited by lack of sufficient airlift.

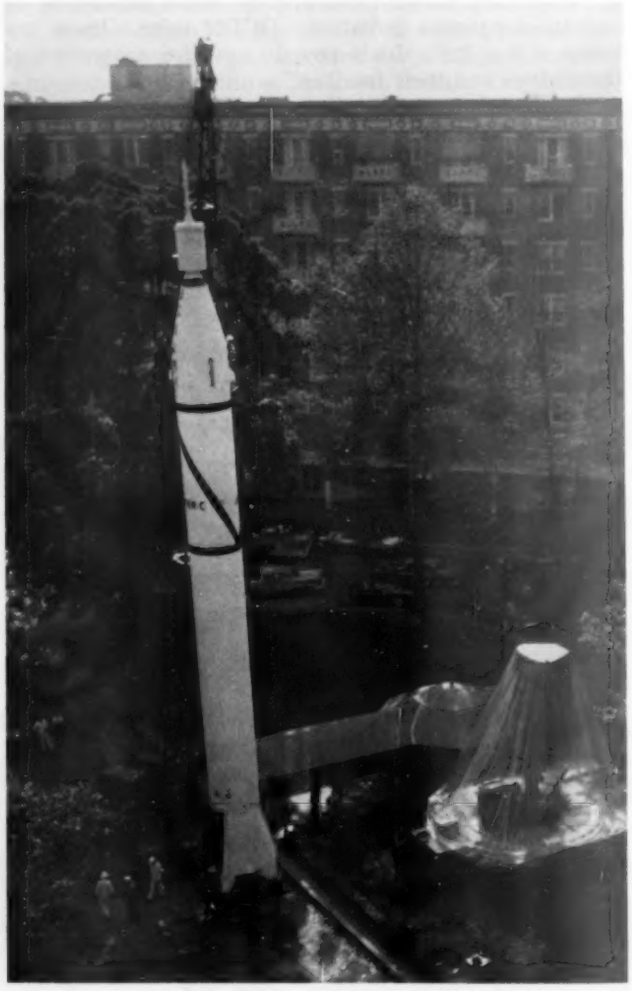
Another phase of the program which was of special interest was a panel discussion on "The Army Looks to the Future," on the morning session of October 22. Moderator for this discussion was Lieutenant General Arthur G. Trudeau, who opened with a review of Army research interests. These included a statement as to the importance of chemical and biological warfare research, reported in the November-December issue of Armed Forces Chemical Journal and also quoted by The Chief Chemical Officer, Major General Marshall Stubbs, in his recent address in New York (Printed in this issue.)

This panel included Major General John B. Medaris, Commanding General U.S. Army Ordnance Missile Command. The panel discussions emphasized the functions of the Army in the missiles and outer-space fields. The addresses by members of this panel, as well as those of others who appeared on the program, are reported extensively in the December issue of the Association's magazine ARMY.

The speaker at the annual banquet was Secretary of the Army Wilber M. Brucker. He reviewed current world problems of Army concern in a speech entitled "Determined Deterrence—America's Best Safeguard Against Aggression."

A number of members of A.F.C.A. attended this meeting of the Army Association. The broad overall program of Army concerns necessarily included only limited attention to the various Technical Services, each of which, however, provided an exhibit. Of rather special interest was that of the Chemical Corps, not only because of the subject matter, but due to its placement in the entrance lobby. It was located immediately to one side of the hat

Jupiter C missile on display at hotel



and coat check booth. Visitors waiting in line to check or claim their wraps were thus facilitated in examining the latest in military and civilian gas masks and reading illustrated panels designed to impart knowledge of nerve gas.

As a symbol of the meeting, a JUPITER C missile, as well as some new radar equipment, was erected and displayed in front of the Hotel. Another noteworthy exhibit was the showing of a recovered JUPITER C rocket engine set up in the lobby of the Hotel.

The program also included a most extensive and well-attended industrial display of missiles, aircraft, and electronic devices of Army concern.

Chemical Corps Exhibit

Recovered Jupiter C engine

1ST CHEMICAL REGIMENT MEMORIAL TREES

Publication of historical matter concerning the 1st Chemical Regiment (inactive) in the past two issues of THE JOURNAL has brought forth still further comment. Herewith a letter from Colonel Herbert C. Roberts, 1027 Bayou Place, Sarasota, Florida, telling about certain trees planted as memorial to deceased members of the Regiment. THE JOURNAL would be pleased to receive additional letters from former members of this unit concerning events in its distinguished record. The letter to the Editor from Colonel Roberts follows:

10 October 1958

During our summer camp in 1935, Uncle Arthur Heritage* was acting post commander. In conversation with him relative to something the Regiment could do as a reminder that we were in camp and as a contribution to the improvement of the post, the idea was suggested by Uncle Arthur, that we could plant a tree as a memorial to those of the Regiment who made the supreme sacrifice.

That year (1935) we purchased two American Walnut trees (one for 1933 and the other for 1935.) They were planted in the ROTC area in a row parallel to the main road, where the officers' tents were pitched. Another such tree was purchased in 1937.

Metal markers were placed on each tree. When I returned to Edgewood after the war and became chief of Edgewood Proving Ground, the Proving Ground was using the buildings in the ROTC area. The metal markers had disintegrated. Merrill Keyser and I trimmed and pruned the trees and had new markers made. We never did get around to completing the job we started to do; namely; but in cement posts with the regimental insignia set into the trees.

I have not been in the area since about 1948 and do not know the condition of the trees. If they are still there, some of us will supply the funds for permanent markers.

As I recall, the Regiment did not go on active duty in 1939, as at that time all the Regular Army units were disbanded, and we were given a number in the 900 series of reserve units.

*Colonel Heritage was then in command of the post, Edgewood Arsenal, Md., now re-named Army Chemical Center.

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CHEMICAL CORPS NEWS

COLONEL GRAYDON C. ESSMAN PROMOTED TO BRIG. GENERAL

Colonel Graydon C. Essman, Commander of the Research and Development Command of the U.S. Army Chemical Corps, stationed in Washington, D.C., was promoted to Brigadier General, effective January 1, 1959.

Born in Independence, Missouri, General Essman attended the University of Missouri for two years before entering the United States Military Academy, from which he was graduated in 1933.

During World War II General Essman served in Southeast Asia and Europe.

COL. FELLENZ ON SELECTION BOARD

EDGEWOOD, Md.—Colonel Lloyd E. Fellenz, commanding officer of the U.S. Army Chemical Warfare Laboratories, here, was appointed to the Army Senior Service College Selection Board, which met in Washington, D. C. last November, to select Army personnel to attend the senior service schools.

OLD TIMERS TURN OUT TO HONOR GENERAL STUBBS AT ROCKY MTN.

Some "old timers" of the Chemical Corps turned out for luncheon in honor of Maj. General Marshall Stubbs at Rocky Mountain Arsenal, Denver, Colo., 29 October 1958, during his first visit there since his recent appointment as Army's Chief Chemical Officer. Left to Right: Mr. H. E. Hughes, Manager of the Shell Chemical Corporation Plant, Denver; Brig. General C. S. Shadle, U.S. Army (Ret), former Commander of the Arsenal; Maj. General Marshall Stubbs; Colonel William J. Allen, Jr., present Commanding Officer; Brig. General J. H. Rothschild, U.S. Army (Ret), Professor, University of Colorado; Colonel C. M. Kellogg, U.S. Army (Ret), former Commanding Officer of the Arsenal.

CML BN RATES SUPERIOR ON ARMY TRAINING TEST

MANNHEIM, GERMANY, (SPECIAL)—The 4th Chemical Battalion (Smoke Generator) received a SUPERIOR rating of 97 on its annual Army training test conducted from October 10 through 12.

Two companies of the battalion, the 44th and the 68th Chemical Companies (SG), supported the headquarters throughout the test. The other two companies of the 4th battalion, the 4th and 51st, assisted in aggressor action.

On Friday, the unit demonstrated its ability to move and assemble in the field while repulsing aggressor attacks, and on Saturday morning the unit concealed a simulated supply center by the use of smoke.

As part of the training test, smoke operations on the Rhine river were coordinated with engineer activities. This involved smoking a swinging bridge while it was being swung, concealing the river and simulated crossings. The operation was observed by Colonel Sam Efnor, Jr., Chemical Officer, Seventh Army.

Lt. Colonel Charles A. Morgan, Jr., the battalion commander, in congratulating the unit, conveyed his personal gratitude to every member of the battalion who assisted in obtaining the SUPERIOR rating.

NEW PROVOST UNIT AT ROCKY MT.

A U.S. Army Provost Marshal Detachment, "9713 Field," has been activated at Rocky Mountain Arsenal, Denver, Colorado. Colonel William J. Allen, Jr., Commanding Officer, presented the guidon to the new Unit's Commanding Officer, Major Anthony M. Lydon. The new unit, which consists of two officers and forty-one enlisted men, is assisted by forty civilian security guards in providing police protection for the Arsenal.

BRITISH BIOCHEMIST PETERS VISITS ARMY CHEMICAL CENTER

EDGEWOOD, Md.—Sir Rudolph Peters, noted biochemist recently elected president of the International Council of Scientific Unions, visited the Army Chemical Center here last October and consulted with Army chemists.

Sir Rudolph, who taught biochemistry at Oxford for 31 years, is known for development of BAL, a neutralizing agent for the poison gas Lewisite. BAL has proven a major scientific achievement due to its effectiveness against mercury and arsenic poisoning in industry.

45 AT FT. McCLELLAN RECEIVE LENGTH-OF-SERVICE EMBLEMS

FORT McCLELLAN, Ala.—Forty-five civilian employees of U.S. Army Chemical Corps activities at this

station were among some 400 Fort McClellan career service employees honored here recently.

Occasion for the commendations was a special Career Service ceremony November 14, during which the Army's new length-of-service emblems were presented to all civil service employees having 10 or more years of satisfactory Federal service.

The Chemical Corps employees awarded emblems for 20 or more years service were Johnie T. Carter, Stanley E. Karp, James E. Rogers, and Eschol Spires of the Chemical Corps School, and Roland P. Fournier of Hqs., Chemical Corps Training Command. Forty other employees received 10-year length-of-service emblems.

Colonel John M. Palmer, commanding officer of the Training Command, addressed the group, and with Colonel Carl V. Burke, commandant, Chemical Corps School, and Lt. Colonel Oliver R. Hertel, of the Chemical Corps Field Requirements Agency, made emblem presentations.

PFC. GINSBURG WINS MEDAL

EDGEWOOD, Md.—Private First Class Arthur J. Ginsburg of the Army Chemical Center, Maryland, was one of the third place winners in the ninth annual Freedoms Foundation essay contest. He was honored at a ceremony at post headquarters and presented with a check for $100 and an honor medal citing him for "outstanding achievement in bringing about a better understanding of the American way of life." Deputy Post Commander Colonel Eugene G. Bennett made the presentation.

The contest, open to men and women of all branches of service, had as its theme "My job—Defending America's Freedoms."

Pfc. Ginsburg's entry was an imaginary conversation between a young man about to enter the Army and his father, a veteran of World War I.

A native New Yorker, Pfc. Ginsburg obtained two degrees from Columbia University and was a teacher of social studies prior to entering the Army.

FOUR EDGEWOOD ENLISTED MEN ARE NAMED "SOLDIERS OF THE YEAR"

SOLDIERS OF THE YEAR—Brigadier General Harold Walmsley, post commander, presents a $50 check to Corporal G. Masterson of Technical Escort Unit, one of the Army Chemical Center's four best "Soldiers of the Year." Awaiting their turns to receive the General's congratulations on being selected "Soldiers of the Year" for this post are (left to right), Specialist Fourth Class Theodore C. Myers, Dental Unit; Privates First Class Chester E. Fraley and Karl J. Torjussen, both of Detachment Three. Immediately following the presentation ceremony, the four winners departed for Washington and a three-day session at the annual meeting of the Association of the U.S. Army as part of their reward.

DR. DAVID B. DILL ON COMMITTEE FOR BIO-ASTRONAUTICS RESEARCH

EDGEWOOD, Md. — Dr. David B. Dill, of the Army's Chemical Warfare Laboratories here, has been named to the Armed Forces-National Research Council Committee on Bio-Astronautics.

Organized in November, the committee was established to assist the Armed Forces on problems related to maintaining life in space.

The group will keep scientists informed of military requirements and attempt to find answers to specific questions concerning the biological aspects of space travel.

Dr. Dill, the deputy director for scientific activities of the Directorate of Medical Research in the laboratories, was nominated for committee membership by the Surgeon General of the Army and approved by the president of the sponsoring National Academy of Sciences.

Holder of a doctorate in biochemistry from Stanford University, Dr. Dill has been associated with the Chemical Corps' medical research program since 1947. He was formerly affiliated with the Armed Forces' Office of Scientific Research and Development.

Since 1949, Dr. Dill has been a visiting lecturer on physiology at Harvard and has received widespread recognition for work at the Harvard Fatigue Laboratory. He is an honorary fellow of the American College of Cardiology.

DETRICK DEVELOPS METHODS FOR RAPID DIAGNOSIS OF DISEASES

CHICAGO, Ill.—A rapid method to diagnose an infection specifically when the infectious bacteria are present in the blood stream is now possible within one or two hours after the collection of blood, two U.S. Army Chemical Corps scientists from the Army Biological Warfare Laboratories, Fort Detrick, Frederick, Maryland, disclosed at the annual meeting here of the American Society of Clinical Pathologists on Nov. 4, 1958.

Doctors John D. White and George P. Blundell, the scientists, explained and demonstrated how they could diagnose plague, rabbit fever and anthrax from smears of blood in hours, instead of days. Mr. George Svarnas, also of Fort Detrick, assisted in the instruction.

This procedure, they pointed out, may prove useful in the diagnosis of other diseases in which the infectious microorganism invades the blood stream. Present diagnostic procedures necessitate the growth of the bacteria in cultures. This requires days.

With the new speed-up method, blood samples taken from sick animals are smeared on glass slides covered with a fluorescent solution of antibodies. The antibodies coat the disease-causing bacteria, which shows as a green glow when examined with a microscope using ultraviolet light.

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Barnebey-Cheney Company, Columbus, Ohio
Bechtel Corporation, San Francisco, Calif.
Becton, Dickinson and Company, Rutherford, N.J.
Bell & Gossett Company, Morton Grove, Ill.
Blaw-Knox Company, Pittsburgh, Pa.
Brown Company, Berlin, N.H.
Casco Products Corporation, Bridgeport, Conn.
Celanese Corporation of America, New York, N.Y.
City Chemical Corp., New York, N.Y.
Columbia-Southern Chemical Corp., Pittsburgh, Pa.
Commercial Solvents Corporation, New York 16, N.Y.
Continental Can Co., Inc., Chicago, Ill.
Continental Oil Co., Ponca City, Okla.
Crane Co., Chicago, Ill.
Diamond Alkali Company, Cleveland, Ohio
Dow Chemical Company, Midland, Mich.
E. I. duPont de Nemours & Co., Inc., Wilmington, Del.
Edo Corporation, College Point, N.Y.
Engelhard Industries, Newark, N.J.
Esso Research and Engineering Co., New York, N.Y.
Evans Research & Development Corp., New York, N.Y.
Federal Laboratories, Inc., Saltsburg, Pa.
Ferguson, H. K., Company, The, Cleveland, Ohio
Ferro Corporation, Cleveland, Ohio
Firestone Industrial Products Co., Fall River, Mass.
Fisher Price Toys, Inc.. East Aurora, N.Y.
Fisher Scientific Co., New York, N.Y.
Fluor Corporation, Ltd., The, Whittier, Calif.
Food Machinery & Chemical Corporation, New York, N.Y.
Foster Wheeler Corporation, New York, N.Y.
Fraser & Johnston Co., San Francisco, Calif.
General Aniline & Film Corporation, New York, N.Y.
General Electric Company, Chemical & Metallurgical Division, Pittsfield, Mass.
General Tire & Rubber Company, The, Wabash, Ind.
Goodrich, B. F., Chemical Company, Cleveland, Ohio
Handy & Harman, New York, N.Y.
Harshaw Chemical Company, The, Cleveland. Ohio
Harvey Aluminum, Torrance, Calif.
Hercules Powder Company, Wilmington, Del.
Heyden Newport Chemical Corporation, New York, N.Y.
Hooker Chemical Corporation, Niagara Falls, N.Y.
Industrial Rubber Goods Company, St. Joseph, Mich.
International Nickel Co., Inc., New York, N.Y.
International Salt Co., Inc., Scranton, Pa.
Kaiser Aluminum & Chemical Corp., Oakland, Calif.
Kennecott Copper Corporation, New York, N.Y.
Koppers Company, Inc., Pittsburgh, Pa.
Lambert-Hudnut Mfg. Laboratories, Inc., Lititz, Penna. subsidiary of Warner-Lambert Pharmaceutical Company, St. Louis, Mo.
Eli Lilly and Co., Indianapolis 6, Ind.
Little, Arthur D., Inc., Cambridge, Mass.
Mason, L. E., Company, Hyde Park, Mass.
Merck & Company, Inc., Rahway, N.J.
Mine Safety Appliances Co., Pittsburgh, Pa.
Minnesota Mining & Manufacturing Co., 900 Fauquier Avenue, St. Paul, Minnesota
Miracle Adhesives Corp., 250 Pettit Ave., Bellmore, Long Island.
Monsanto Chemical Company, St. Louis, Mo.
National Cylinder Gas Co.—Chemical Div., Chicago 11, Ill.
Niagara Blower Co., New York, N.Y.
Olin Mathieson Chemical Corp., East Alton, Ill.
Oronite Chemical Company, San Francisco, Calif.
Pemco Corporation, Baltimore, Md.
Pennsalt Chemicals Corporation, Philadelphia, Pa.
Pfizer, Chas. & Company, Inc., Brooklyn, N.Y.
Phillips Petroleum Company, Bartlesville, Okla.
Pittsburgh Coke & Chemical Co., Pittsburgh, Pa.
Proctor & Gamble, Cincinnati, Ohio.
Reynolds Metals Company, Louisville 1, Ky.
Shea Chemical Corp., Jeffersonville, Ind.
Shell Chemical Corp., Denver, Colo.
Shell Development Company, Emeryville, Calif.
Sheller Mfg. Co., Dryden Rubber Div., Chicago, Ill.
Shwayder Bros., Inc., Denver, Colo.
Standard Oil Company (Indiana), Chicago, Ill.
Stauffer Chemical Company, New York, N.Y.
Sun Oil Company, Philadelphia, Pa.
Union Carbide Corporation, New York, N.Y.
United-Carr Fastener Corp., Cambridge, Mass.
Universal Match Corp., Ferguson, Mo.
Vitro Corporation of America, New York, N.Y.
Vulcan-Cincinnati, Inc., 120 Sycamore St., Cincinnati 2, Ohio
Witco Chemical Company, Chicago, Ill.
Wyandotte Chemicals Corp., Wyandotte, Mich.

Companies listed in bold face type are Sustaining Members

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Pretax earnings average 6.4% or $6,400 on each $100,000 of product you sell, after raw materials, sales expenses, overhead and miscellaneous are deducted.*

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Here are a few factors to consider:

(1) Columbia-Southern may develop, through a study of your operations, potential savings in your converting from bag to bulk purchases.

(2) Savings also may become apparent in a study of Columbia-Southern's three Soda Ash plant locations, selected for maximum delivery efforts.

(3) Further possibilities may exist through the kind of help Columbia-Southern can give you in specialized technical assistance and in recommendations for profitable handling and storage procedures.

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*Based on Manufacturing Corporation Statistics for first half of 1958.

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